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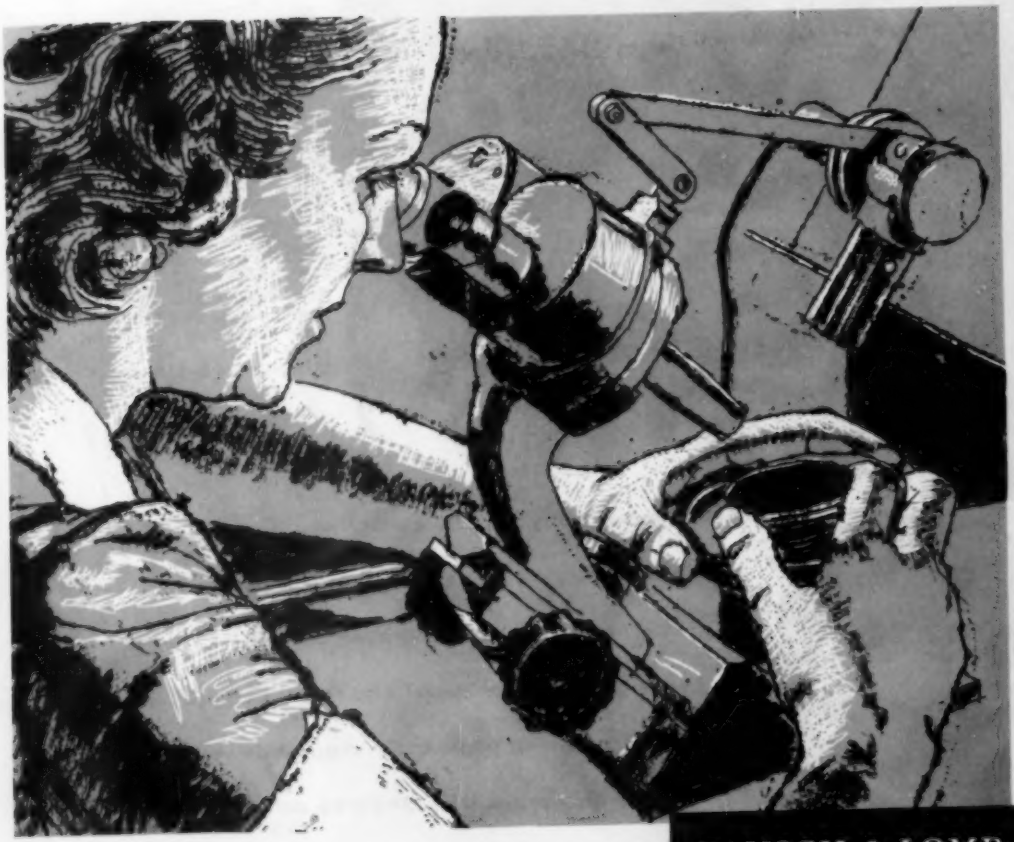

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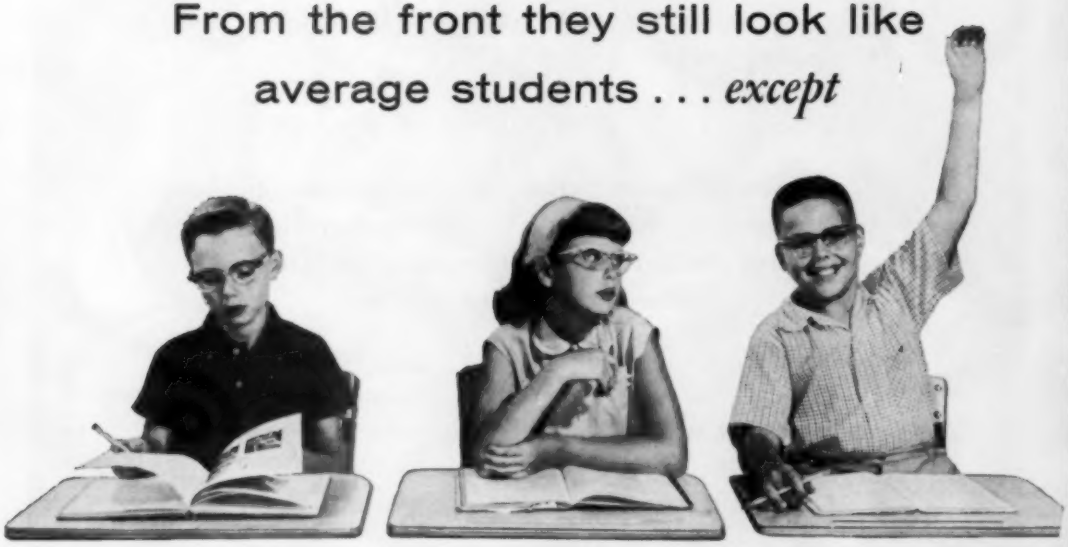

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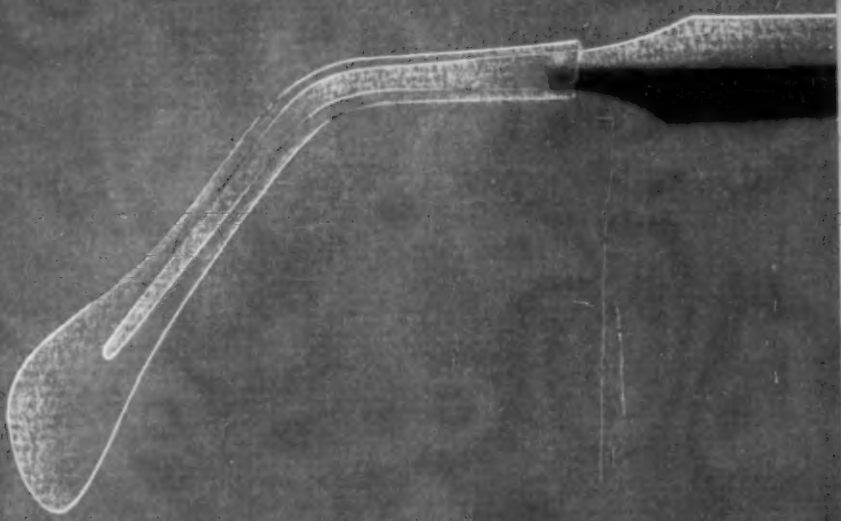

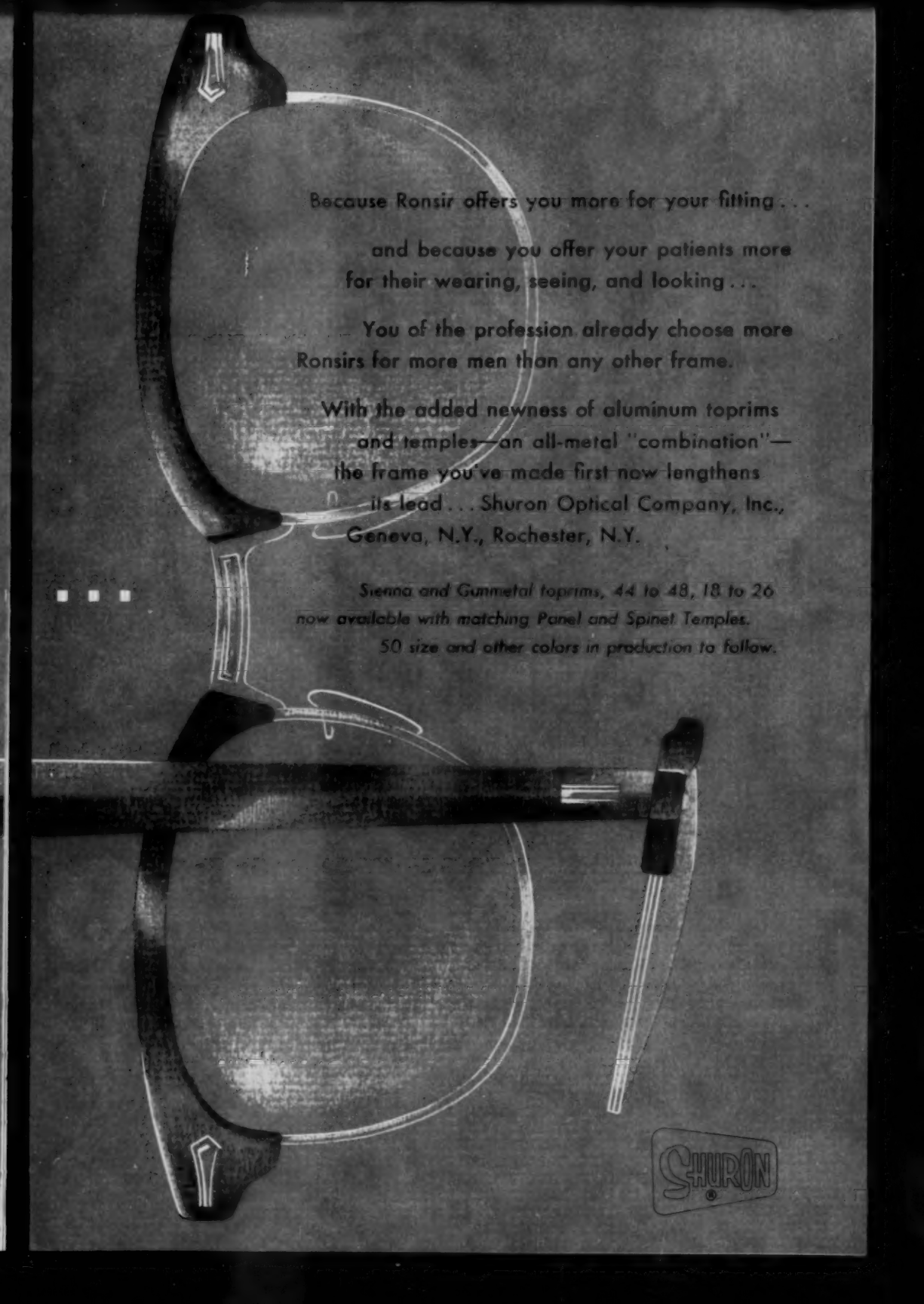
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CONVERGENCE ACCOMMODATION*

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That there exists an association between the functions of accommodation and convergence few, if any, authorities would dispute today. The degree of freedom of one in relation to the other is, however, still a matter of controversy. Both Donders[1] and Landolt,[2] who conceived of considerable latitude of each function free of the other, and Maddox,[3] who thought that there was no independent action of either in relation to the other, have their followers. Thus Duke-Elder[4] speaks of the relationship between accommodation and convergence as being elastic. Ames and Gliddon,[5] however, concluded as a result of their work, that the relationship between the accommodative condition and the vergence condition is definite and fixed and that one cannot be changed without producing an effect upon the other.

As Morgan[6] has pointed out, the critical investigations of Emmes,[7] Ames and Gliddon,[5] Morgan,[8] Hofstetter[9, 10, 11] and Morgan and Peters,[12] all resulted in essentially the same conclusion. Any change of accommodation results in a change of convergence which is linearly related to the accommodative change.** The accommodative-convergence-accommodation (AC/A) ratio has been found to vary with individuals but, for a high percentage, the value is between 3 and 5 prism diopters per diopter of accommodation.

Convergence accommodation has been described by Pascal[14] as the amount of accommodation which is the result of, or occurs with, an innervation to convergence. Fry's[15] definition is "that amount of accommodation which is fully associated with convergence when the need for exact focusing has been eliminated."

Convergence accommodation has not been investigated as exten-

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*Read before the annual meeting of the American Academy of Optometry, Chicago, Illinois, December 10, 1957. For publication in the August, 1958, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

This paper was submitted in partial fulfillment of the requirements for the Master of Optometry degree at the School of Optometry, University of California, Berkeley, California.

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**Westheimer[13] agrees that for clinical purposes the relationship between accommodation and convergence may be considered linear but that more critical studies are necessary in order to exclude non-linearities for theoretical purposes.

sively as has accommodative convergence, primarily because simple techniques of investigation are not applicable. The problem is that involved in determining the amount of accommodation stimulated solely by convergence while the subject maintains fixation. If the fixation target is allowed to appear blurred, as accommodation changes, the blurred image constitutes a stimulus for further accommodative change. Extraneous stimuli may thus be introduced, preventing the measurement of accommodation associated solely with convergence.

Tait[16] in 1928, presented a paper on dynamic skiametry in which he discussed what he referred to as the lag of accommodation behind convergence. He considered positive relative accommodation and convergence accommodation to be synonymous terms. It should be clear, however, that the interposition of a measuring lens to determine the amount of positive relative accommodation manifested would in itself alter the stimulus to accommodation. Convergence accommodation, or the amount of accommodation stimulated solely by convergence could not, therefore, be measured by this method.

Fry[15] also investigated the measurement of convergence accommodation by skiascopy. He found that the stimulus for exact focusing was not eliminated even when a coarse fixation target was used as suggested by Pascal.[14] He concluded, therefore, that accommodation whose only stimulus was convergence could not be determined by skiascopy.

Fincham[17] and, after him, Morgan,[18] have, however, demonstrated convergence accommodation. Fincham used a coincidence optometer-haploscope apparatus. The fixation target was a small white disc with a black spot in the center. In order to eliminate the effect of changes in the vergence of the light reaching the retina, which would induce changes in accommodation, he used 0.50 mm. exit ports for his optical system. Thus the fixation target was seen through pinholes located in the plane of the exit pupils of the two eyes. Under these conditions convergence was varied and the accommodation in play measured with the coincidence optometer.

Fincham found that the accommodative response varied with convergence. He also noted a difference in response between subjects of different ages. For a subject age 23 he found essentially a one-to-one relationship between convergence and accommodation. Stated another way, the amount of accommodation induced was sufficient to focus the eyes for the point upon which they were converging. Another subject, approximately 41 years of age, exhibited about one-half the response per unit of convergence as did the 23-year-old. He attributed the de-

crease in the accommodative response per unit of convergence shown by older subjects to the increased amount of ciliary force necessary to effect a given amount of accommodation.

Morgan,[18] in 1954, demonstrated convergence accommodation using the principle of stigmatoscopy to measure accommodation and the angle between the two arms of the haploscope to measure convergence. He found, for one subject, a response of accommodation to convergence which differed widely from the subject's AC/A ratio and was not linear for the whole extent of the response curve.

Fincham[19, 20] considers that convergence provides the voluntary, coarse, stimulus to accommodation, with only fine adjustments made independent of convergence. He called this fine adjustment "reflex accommodation." Fincham suggests that there are two factors involved in the stimulation of this reflex. These are: 1. chromatic aberration as it varies with the vergence of the light incident upon the retina, and 2, small scanning movements. These so-called fine adjustments, effected by reflex accommodation, are operative through a range up to 2 or 2.5 diopters.

Heath[21] has postulated four components of accommodation. These are: 1. Tonic (or condition of rest of the accommodative mechanism), 2. Convergent, 3. Proximal or Psychic (induced by the apparent nearness of an object)*, and 4. Reflex. It was his conclusion that the reflex component is generally the most potent determinant of the accommodative level.

Of some interest in the interplay between accommodation and convergence is the question as to which is the leading or first innervated function. Allen,[23] in 1953, did the most critical work on this problem. He showed that convergence is the first acting, but attributed the difference in reaction time of 0.3 seconds for accommodation and 0.2 seconds for convergence, principally, to the longer latent period of the ciliary muscle as compared to the internal rectus muscle. He concluded that accommodation and convergence are probably innervated simultaneously.

Whether one assumes that accommodation or convergence is innervated first, or both simultaneously, it is evident that, considering the various clinically observed combinations of ametropia and heterophoria, there must be a reciprocal interplay between these two functions in the interest of clear single binocular vision. Inhibitory or supplementary innervations may be called for to subserve this visual state.

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*Hofstetter[22] found no evidence for proximal accommodation.

PURPOSE OF INVESTIGATION

It was the intent of this investigation to 1, test the conclusion of previous investigators that the act of convergence stimulates accommodation, 2, if confirmed, then to investigate the response of accommodation to various stimulus values of convergence, and 3, to compare the response of accommodation to convergence of subjects with different amplitudes of accommodation.

METHOD

The apparatus used was the same as that used and described by Morgan.[18] It is illustrated schematically in Figure 1. The apparatus

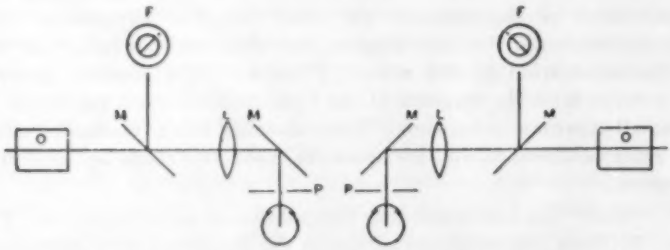

Fig. 1. Schematic representation of apparatus.

comprised an haploscope with two sets of half silvered mirrors at M. The secondary focal point of the projection lenses, L, coincided with the entrance pupils of the observer's eyes. Accommodation was measured with an optometer, O, using the principle of stigmatoscopy. The fixation targets, F, were two concentric rings fitted with suppression cues. In order to render the system essentially non-focal these targets were observed through 1 mm. pinholes, P, centered in red plastic filters. The fixation targets were colored green by green filters placed behind them. When the subject was positioned before the haploscope he could see the green fixation target only by looking through the 1 mm. pinholes centered before each eye. The vergence of the light from the fixation targets could be made to vary over a considerable range without subjective blur. The spots of light emitted by the optometer were white. When these were observed through the pinholes in the red filter, and were not conjugate with the retina, the spot of light was surrounded by a red corona. As the optometer target approached conjugacy with the retina the corona decreased in size. Conjugacy was assumed when the corona had shrunk to the same size and occupied the same position as the small white spot of light seen through the pinhole. Each optometer setting, then, was based upon conjugacy of the minimal red

corona. As relative, rather than absolute, values of accommodation were of interest in this experiment the data were not converted to comparable values for white light.

The subject fused the fixation targets and then adjusted the optometer for conjugacy, first the right eye and then the left eye. The angle between the haploscope arms was then changed for a different convergent position and the optometer settings repeated. For each convergent position the average accommodative value was determined for each eye. It was found, for all subjects, that there was good agreement in the optometer settings for right and left eyes. The plot point for each convergent position represents a mean of the accommodative values for right and left eyes and is based upon a minimum of 10 optometer adjustments. The least amount of induced accommodation was plotted at zero on the graph for each subject. The position of the visual axes when this lowest value was obtained was usually one of slight divergence.

Convergence was measured in degrees at the centers of rotation of the two eyes and converted to prism diopters by multiplying the tangent of the angle by 100.

It should be pointed out that the findings are, to some extent, influenced by the method of taking data. The data were normally taken in regular progression from low to high values of convergence. For one subject the procedure was repeated using a random selection of consecutive convergence values. The slope of the curve was not significantly changed throughout the mid range (5° to 15°) but differences were apparent at low and high convergence values. For another subject the data were taken in the usual manner with increasing values of convergence to the limit of fusion, and then in reverse order to zero convergence. Again the two curves were similar in the middle range but slope differences occurred at either end. This is illustrated in Figure 2.

As one of the primary objectives of the experiment was to determine if a relationship existed between convergence accommodation and accommodative amplitude it was necessary to establish some criterion for measuring the average amount of accommodation induced per unit of convergence for each subject. Any method of establishing such a criterion must, of necessity, be an arbitrary one with a resultant influence upon the data.

After several methods were tried and rejected the following criterion was adopted. The average amount of accommodation induced per unit of convergence was determined by differentiation, for each subject, over

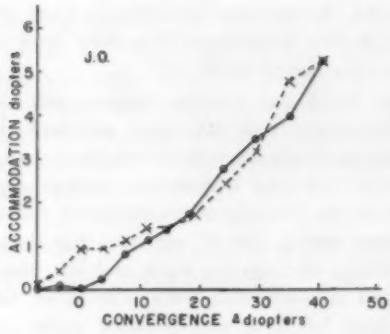

Fig. 2. Comparison of stimulation and relaxation of convergence in its effect upon accommodation for one subject.

the whole range of convergence through which fusion of the fixation targets were maintained. Next, the standard deviation of the data was determined in the middle range of induced accommodative values for each subject. That portion of the curve where the slope departed no more than one-half of one standard deviation from the average was then determined. The slope of this portion of the plotted curve was then considered representative for each subject. It included the middle range and varying amounts at either end depending upon the reliability of the subject and the rate of slope change.

The standard deviation of the data taken at extreme convergent postures ranged from 1½ to 4 times that found for the middle range of these values. Thus the slopes of the derived curves are not as reliably established for high values of convergence as for lesser values.

The accommodative amplitude was determined monocularly by the "push-up" method. Each determination was the mean of at least three measurements. The amplitude was referred to the spectacle plane so as to conform to the plane of the haploscopic findings.

RESULTS

Seventeen individuals with sufficient fusion to serve as subjects were found. Their ages ranged from 9 to 48 years. Fifteen of the subjects had an amplitude of accommodation commensurate with their age. One subject, 22 years of age, had a reduced amplitude (4.4 diopters) from an unknown cause. Another subject, age 25 years, had a higher than normal amplitude (14 diopters) for his age.

Convergence accommodation was plotted against convergence for each subject. As convergence increased there was an associated increase in accommodation for every subject. For none of the subjects was this

relationship linear throughout the whole range of induced values. The departure from linearity was small for two subjects, however. Most subjects showed a varying response of accommodation to successive low values of convergence, followed by an essentially linear response for the middle range of convergence values (10 to 30 prism diopters). At extremes of convergence the increments of induced accommodation differed from one subject to another. The greatest variation was apparent when subjects with significantly different amplitudes of accommodation were compared. Typical curves, plotted for three subjects, are illustrated in Figure 3.

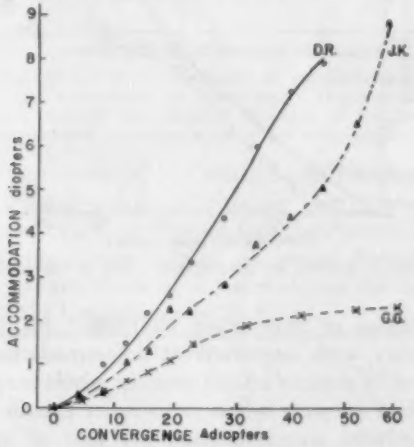

Fig. 3. Accommodation induced by convergence. The ages and accommodative amplitudes of the three subjects were as follows: D.R. 22 years and 11 diopters; J.K. nine years and 16.3 diopters; G.G. 22 years and sub-normal amplitude of 4.4 diopters.

Figure 4 illustrates the test-retest variation for one subject. The solid line curve was derived from data obtained 11/24/56. The data for the dashed line curve was obtained on 3/17/57.

The change in induced accommodative response with loss of accommodative amplitude is strikingly illustrated in Figure 5. The curve for 10/7/53 was extracted from a paper published by Morgan[18] in 1954. The same subject (the author) was tested again on 10/15/56 and the new data are represented by the solid line curve. It is apparent that the differential pressure exerted by the elastic lens capsule became significantly less effective during the intervening three years. This period happened to coincide with the onset of presbyopia.

The amount of accommodation fully associated with convergence,

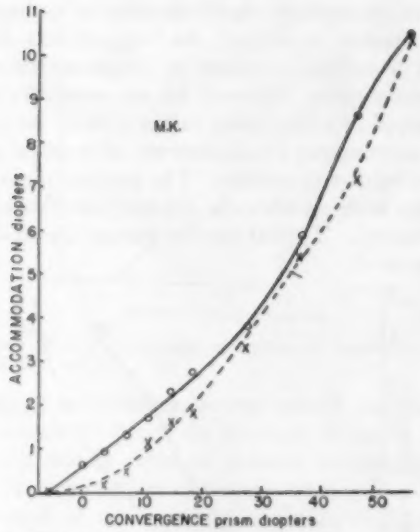

Fig. 4. Accommodation induced by convergence. Test re-test variation for one subject age 11.

under the conditions of observation established for this experiment, was found to vary with amplitude of accommodation. It was not, however, found to be directly related over the whole range of amplitudes studied. The three subjects whose amplitudes exceeded 11.6 diopters exhibited less induced accommodation per unit of convergence (by applying the criterion adopted to determine the average amount of induced accommodation) than did those with amplitudes ranging from 10 to 11.6 diopters. The amount of associated accommodation decreased with amplitude, in a fairly regular manner, for amplitudes from 10 down to 2.4 diopters. Figure 6 is illustrative of these findings.

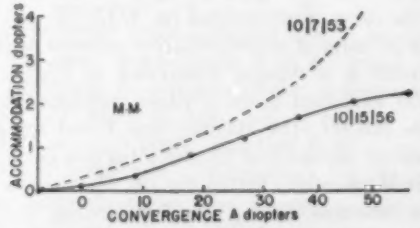

Fig. 5. Difference in accommodation induced by convergence, for the same subject, with a change in the accommodative amplitude. Amplitude on 10/7/53 was 9.5 diopters and on 10/15/56 it was 4.7 diopters.

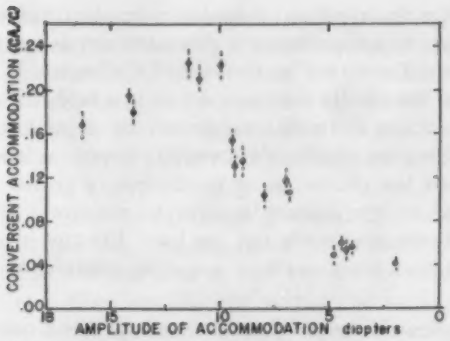

Fig. 6. Relationship of CA/C to amplitude of accommodation. Each small circle is representative of that relationship for one subject. The extensions above and below the small circles each represent one standard deviation of the data computed for the middle range of the recorded convergence values for each subject.

Another illustration of the relationship between accommodative amplitude and induced accommodation per unit of convergence may be obtained by means of a ratio relating these two quantities. The average amount of accommodation induced per prism diopter of convergence was divided by the amplitude of accommodation for each subject. The result appears as the last column of Table I.

TABLE I

Subject	Age	P.D.	Amp. of Acc.	Mean CA/C	CA/C × 100 / Amp. of Acc.
J.K.	9½	57	16.3	0.170	1.04
M.K.	11	58	14.1	0.194	1.38
P.K.	18	63	11.6	0.224	1.93
D.N.	22	63	10.0	0.222	2.22
D.R.	23	64	11.0	0.210	1.91
G.G.	23	69	4.4	0.060	1.36
F.D.	25	62	14.0	0.180	1.28
J.O.	27	67	9.4	0.131	1.39
P.C.	29	60	9.5	0.152	1.59
B.S.	29	67	9.0	0.135	1.50
N.R.	31	64	8.0	0.105	1.31
C.G.	34	64	6.9	0.106	1.54
R.H.	36	60	7.0	0.117	1.67
S.O.	40	66	4.0	0.056	1.40
M.M.	44	68	4.7	0.049	1.04
M.G.K.	45	62	4.3	0.053	1.23
P.R.K.	48	66	2.4	0.041	1.71

$$CA/C = \frac{\text{Convergence Accommodation (diopters)}}{\text{Convergence (prism diopters)}}$$

DISCUSSION

The implications of the variation in the amount of accommodation induced by convergence is important in a consideration of accommodation theories, as Fincham[17] has pointed out. Fincham's[24] modification

of the Helmholtz theory of accommodation implies that increased ciliary effort is necessary to accommodate a given amount as one becomes older. This is in contradistinction to the Hess,[25] Gullstrand,[26] Fuchs[27] interpretation of the Helmholtz theory in which it is held that no more effort is involved in accommodating one diopter by a presbyope than by a youth. According to Fincham's capsular theory, as the substance of the lens becomes less pliable, as in presbyopia, a greater molding force must be exerted by the capsule in order to produce a given change of curvature of the anterior surface of the lens. For this increased molding force to be effected there must be a greater contraction of the ciliary muscle.

First Thomas Young,[28] then Tscherning,[29] and others, by various techniques proved that, for children and most young adults at least, the contour of the anterior surface of the fully accommodated lens is hyperbolic rather than spherical. Fincham[24, 30, 31] has postulated that the form assumed by the anterior lens surface during accommodation is a result of the elastic nature and varying thickness of the lens capsule. He refers to Salzmann's[32] table of histological measurements, as well as determinations of his own, as evidence of this variation in thickness of the capsule. Salzmann's table of comparative capsular thicknesses indicates a variation in capsular thickness over the surface of the lens for an individual of any age. In addition there are differences in thickness differential between individuals of nearly the same age, and, in particular, between individuals of significantly different ages.

The accommodative level, considered from a mechanical standpoint is, then, according to Fincham's theory, the resultant of two opposing forces. These are the capsule, which varies in thickness over the surface of the lens, and the resistant lens substance. If it can be assumed that the molding force exerted by the capsule is in proportion to the differential capsular thickness of the anterior surface of the lens then there should be some optimum relation between this thickness differential and the resistance of the lens substance. When this optimum relation exists there should be a maximum convexity of the anterior surface of the lens for a given relaxation of the suspensory ligament.

The apparent paradox of decreased rates of induced accommodation by the subjects of this experiment with the highest amplitudes of accommodation, when compared with subjects of somewhat lower amplitudes, is difficult to resolve. It might be suspected that this is the result of expected scatter in the ranking order or an artifact of method. As the sample was small and an arbitrary criterion was used neither of these explanations can be ruled out. Two facts, however, depreciate

these explanations. First, the decrease is greater than is to be expected on the basis of scatter, and, second, the findings appear to be similar in this respect to those obtained by Fincham[17] if his subjects had normal accommodative amplitude for their age. He shows the highest rate of induced accommodation for a subject about 20 years of age. Lesser amounts were induced by subjects who were approximately 11, 12, and 17 years old.

In order to attempt an explanation several factors should be considered. Two of these are: 1, the resistance offered by the lens substance which, because of the peculiar structure of the crystalline lens is, in itself, a complex consideration not within the scope of this paper, and 2, variations in the thickness (and, perhaps, elasticity) of the lens capsule between individuals of the same and of different ages. Although Salzmann's tables do not indicate this it may be that the width and position of the thickest portion of the anterior capsule varies between individuals of the same, and, particularly, of different ages. Support of this may be inferred by the fact that Fincham found the maximal thickness of the anterior capsule differently situated in relation to the anterior pole than did Salzmann. The three subjects in this experiment with the greatest accommodative amplitudes may have had a relatively narrow and more peripherally situated band of thickest capsular tissue on the anterior surface of the lens. Initial slackening of the suspensory ligament may then have resulted in a more spherical bulging forward of the anterior lens surface. With increased relaxation of the ligament, resulting in more compression of the lens substance, the anterior surface may have become more hyperbolic in form. The three subjects with amplitudes from 10 to 11.6 diopters, on the other hand, may have had a wider band of thick anterior capsular tissue whose inner margin lay nearer the anterior pole. Thus initial slackening of the suspensory ligament may have resulted, for these subjects, in a more steeply curved or more hyperbolically deformed anterior lens surface than for those subjects whose band of thickest anterior capsular tissue was located more peripheral to the anterior pole. Because of the limits within which the lens may be deformed, the convexity attainable by the lens surfaces is, of course, limited. For those subjects whose amplitudes ranged from 10 down to 2.4 diopters the form of the accommodated lens may have been increasingly influenced by a thickening of the capsule at the anterior pole as well as an increasingly resistant lens substance.

This investigation confirms the findings of previous investigators that even a small stimulus to convergence results in a change of the

accommodative level. Any freedom of action which convergence may enjoy, then, is not the result of failure by convergence to induce a potentially effective innervation to accommodation.

CA/C has previously been defined (Table I) as the amount of accommodation (diopters) induced by convergence, divided by the convergence (prism diopters). It is well known that the convergence (expressed in prism diopters) necessary to bi-fixate a point may be calculated by multiplying the P.D. (measured in cm.) and the accommodation (diopters) necessary to attain conjugacy for this point. Substituting,

$$CA/C = \frac{\text{Acc. (diopters)}}{\text{P.D. (cm.)} \times \text{Acc. (diopters)}} = \frac{1}{\text{P.D. (cm.)}}$$

This relationship, yielding the amount of convergence induced accommodation per unit of convergence necessary to attain conjugacy for the point bi-fixated, is applicable for any fixation distance. When this computation was applied to the data obtained in this experiment it was possible, based upon the results, to divide the subjects into two groups. These are: 1, subjects who induced more than the necessary amount of accommodation to attain conjugacy for the point of fixation, and 2, subjects who induced less than the necessary amount. A third group is theoretically possible, namely those who induce precisely the amount of accommodation necessary. It is evident that the first group must inhibit accommodation if the amount induced exceeds the depth of focus. The second group, subject to the same qualification, has need for supplementary accommodation. An analysis of these computed data suggests that if the amplitude of accommodation is 10 diopters or more (as determined by the "push-up" method), convergence is capable of inducing sufficient, or more than sufficient accommodation to focus the eyes for the point upon which they are converging. Convergence appears to be capable of providing the principal stimulus to accommodation even with amplitudes no greater than six or seven diopters. With lesser reserves other components must, within the individual's amplitudes, play an increasingly dominant role in the act of accommodation.

SUMMARY

Under the conditions imposed for this investigation, accommodation was found to vary with convergence. The amount of accommodation induced by a given convergence value was also found to vary with amplitude of accommodation. The amplitude does not appear to be the sole determinant of the induced accommodative level for a given convergence value, however. One possible explanation utilizing Fincham's capsular theory of accommodation is discussed.

Based upon the results of this experiment, convergence appears to be capable of inducing sufficient accommodation to bring the eyes into focus for the point bi-fixated if the amplitude of accommodation is 10 diopters or more. As the amplitude of accommodation decreases other components of this function must play an increasingly important role.

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CORRESPONDENCE

ERRATA

To the Editor:

In the July issue under the heading, "News Briefs," page 392, you mention that Dr. Ernest A. Hutchinson and I were awarded Honorary Doctor of Ocular Science Degrees by the Los Angeles College of Optometry at the commencement program in June.

This is correct, however you follow with the statement that we have both retired. As for Dr. Hutchinson that is correct but not in my case. I am still in active practice of optometry and at present am conducting two offices, two days a week in the Hollingsworth Building, 606 South Hill Street, Los Angeles, and three days weekly at my residence office in South Pasadena.

This is my forty-fifth year in practice in Los Angeles and I had seven years in practice in Canada before coming here, making a total of fifty-two years. In 1913 I became associated with my uncle, Dr. M. B. Ketchum, in conducting the Los Angeles College of Optometry and have been on the Board of Trustees ever since. Am now secretary of the Board while my associate in practice is now chairman of the Board. He is Dr. John R. Dean with whom I share offices in Los Angeles.

Yesterday, August 6th, I passed my seventy-ninth birthday and am still in a good physical condition. You might in your next issue correct this statement about my retirement so my many friends both in the west and east may know I am still in practice.

WM. M. KETCHUM, O.D., D.O.S. (HON.)

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SOCIOLOGICAL PERSPECTIVES OF THE PROFESSION OF OPTOMETRY*

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The fields of work known as the professions have been the subject of much interested inquiry by sociologists and others. Such scholars as Carr-Saunders,[1] Marshall,[2] and Parsons,[3] have devoted attention to the general aspects of the professions. Detailed descriptive accounts are to be found in the volume by Lewis and Maude,[4] and prospectively in the forthcoming volume by Goode, Merton, and Huntington.[5] In recent years, this interest has intensified. In the comprehensive review of sociology edited by Zetterberg, under the auspices of UNESCO, a chapter by Huntington[6] reviews recent development in this interest.

Analyses of this sort are perhaps novel to practitioners within particular professions, who are often caught up in the detailed affairs of their own practice or in the training of new entrants to their field. Such persons, while well informed about aspects of their own professions, may lack the opportunity to perceive the entirety of their profession or to understand how its structure compares with those of other fields of work, or, indeed, of other professions. As a result, the presentation of an objective sociological perspective concerning their profession, concerning its structure, and concerning the careers of persons within that structure, may provide a point of view that ordinarily is missed. The intent of this paper is to present a perspective of selected aspects of the profession of optometry.

Systematic research of an empirical sort on particular fields of work has but recently begun. Occupations and professions, other than optometry, are being widely studied. These include funeral directors and embalmers,[7] restaurant workers,[8] school teachers,[9] college profes-

*Completed as part of a larger research study of occupational and professional roles, carried on with the support of a research grant from the University Research Committee, Graduate School, The University of Wisconsin. Modified from a paper read before the annual meeting of the American Academy of Optometry, Chicago, Illinois, December 8, 1957. For publication in the August, 1958, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

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sors,[10] labor union leaders and labor union staff experts,[11] furriers,[12] janitors,[13] nurses,[14] physicians,[15] city managers,[16] pharmacists,[17] factory workers,[18] steel distributors,[19] lawyers,[20] marine radio men[21] and many others. Such studies are of many different kinds. Their focus is not limited to questions, simple to ask but extremely difficult to answer, about the motivations brought by aspirants to and subsequently shaped by their fields of work and people encountered in them. Some research has concerned the ways in which persons in particular occupations or professions respond to changes in work activities, changes brought about by technological innovations, by clientele pressures, by the variable acceptance of their work in the community. Other studies concentrate on aspirations regarding the future of work specialists and the sundry influences that affect both the content and the incidence of different types of content at the several stages of the careers of these specialists. Still others have emphasized the ways in which the organizational setting within which people work, or, earlier, prepare for their work roles, affects the orientation of these people to their work tasks, and to fellow practitioners, to specialists with other occupational or professional designations, and to their clientele. In addition, a growing body of research concerns the occupational or professional person within the community. References to much of this literature in the sociology of work are found in Caplow.[22]

Such sociological analyses do not exist for optometry, though Hofstetter's perceptive study[23] represents a beginning. Sociological data of an empirical sort gathered systematically by scientific methods regarding the above mentioned areas have not been collected for the profession of optometry. In the judgment of the authors, such data would contribute greatly to the profession of optometry itself; in addition, such data would permit the expansion of general sociological knowledge of work and of the occupations and professions associated with work functions in society.

This paper is intended to establish a basis for the analysis of the profession of optometry. Subsequent to that, it presents a series of tentatively formulated questions regarding the profession and practitioners within it, with appended speculative answers. Extended further research is necessary to broaden and to validate the statements, to specify the questions more precisely than they can here be formulated, and to provide the data essential for the answering of the questions, in a manner satisfying both to optometrists and to sociologists.

PROFESSIONAL STRUCTURE IN OPTOMETRY

A profession such as optometry can be described as consisting of

a set of units or structures that are integrated in such a fashion that the consequences of the activities of each part of the system affect the other units and the interrelationships among these units. A system of this kind is characteristic of all of those fields of work known as the professions; such a system is approximated in varying degrees by those fields which are in process of becoming professionalized.

Viewed purely in terms of its internal organization and with some partial reference to external relationships, such a system can be said to consist of the following major units:

1. the practitioner,
2. the training organizations,
3. the voluntary associations,
4. the legal bodies, and
5. the organized entities characteristic of the field.

THE PRACTITIONER

In any profession the key person is the practitioner, a person employing particular skills and applying the specialized knowledge of the field. The optometrist's work consists of such activities as refracting, visual training, dispensing and furnishing related visual services to the public. Optometrists are typically independent practitioners although substantial numbers practice jointly. Ordinarily they do not engage in any other occupation or profession. At the same time there is some overlap in the performance of these functions with other specialties, such as dispensing opticians and ophthalmologists. The optometrist's work depends partly on the application of basic knowledge derived from specialized fields of knowledge such as physiological optics, physics, biophysics, general and ocular anatomy, geometric optics, and the like, as well as general and visual psychology and fields having to do with human behavior and social institutions.

A critical characteristic of the optometrist, and of his position as a professional man in the community, is that his practice continually involves him with members of the public, rather than mainly, as in some other professions, with professional colleagues. As a result, the impressions of him and of his professional stature by the public are of major importance. It would be important, therefore, to determine by sociological investigation the common features and the variations that exist in the impressions of the optometrist accepted by the public and by subgroups of the public. Such impressions, accurate or inaccurate from the point of view of professional optometrists in particular communities and neighborhoods, constitute important bases upon which the public acts in dealing with them. If lower status people in the community

view the optometrist as a tradesman or businessman, then, it may be assumed, they may act toward him as a tradesman or businessman. At the same time, we may ask to what degree optometrists respond to, and alter their behavior in accordance with, such conceptions or misconceptions of their position and their work functions. In this same general area, one may speculate about the consequences for the optometrist's position in the public eye of his participation in community organizations and associations. If, to paraphrase Hofstetter's words, the optometrist feels repeatedly obliged to prove his worth and to justify his vocation, in comparison with the medical practitioner[23] and thereby engages in a variety of civic projects, how does this in turn affect acceptance of him and of his work activities by the public in his community?

THE TRAINING ORGANIZATIONS

The institutions that supply qualified persons to the profession have varied historically from the prototype of the medieval guild and company to modern day apprenticeship programs, proprietary schools, independent colleges, and university-affiliated programs. The development of these several programs has been accompanied by a lengthening of the entrance requirements concerned with previous education and the increasing formalization of curricula.

Generally it may be expected that the longer the training program, the more likely it is that the student will fully share the attitudes and self-concepts of the professional men already practicing in the field. At the least, the values and beliefs of the educators in a profession, it may be expected, come in some large measure to be transmitted to and possibly accepted by those in training. As a result, should there be substantial divergencies in point of view or perspective between the practicing optometrists and those currently charged with the responsibilities of educating new entrants to the profession, it could be expected that the body of graduating students will acquire motivations during the course of their training that differ in substantial degree from those of practitioners who qualified at previous times. In optometry, this might have substantial significance considering changes in orientation toward commercial practices accepted by many already in practice or by the body of students in training.

VOLUNTARY ASSOCIATIONS

The voluntary associations in optometry include those professional organizations which optometrists join. Such organizations, covering different geographical areas or different functional areas in optometry, do not include all practitioners. In a few professions, such as law, with the so-called integrated bar found in some states, membership in such

professional associations is mandatory. In many professions, ranging from medicine and engineering to teaching, membership is partial, although some handicaps to practice may exist for non-members.[24] Hofstetter reports that about two-thirds of the practicing optometrists in 1944 were members of the American Optometric Association. Actual membership for the practicing optometrists occurs through a local organization, such as, in Wisconsin, through the local organization of the Madison Area Optometric Society, itself a subdivision of the Wisconsin Optometric Association. At the state and national levels, the organizations publish newsletters, magazines, informational releases, educational and other materials, conduct educational programs, present annual meetings with speakers, programs, panels, and the like. Participation in such activities would be expected to furnish the practitioner with attitudes and motivations that encourage him to pattern his conduct in accord with the standards that optometrists, through these organizations, hope to see adopted as normative. At the same time, one would expect that the optometrists who do not participate in such activities would be less likely to accept these standards as guides to their professional activities than those who do. Occasionally, new associations arise as particular segments of practitioners feel their own interests may be served best outside old frameworks. A substantial part of the history of the organized components of all professions consists of such shifts in voluntary associations and the attempt by practitioners, through these agencies, to change old conduct forms and to develop new ones, perhaps at variance with standards under the influence of the older associations.

These organized bodies serve as interest or pressure groups whereby optometrists present points of view to governmental bodies or community agencies and deal with the agencies and organizations of other professions. It would be a matter of great interest for the study of optometry to determine the pattern of activities these organizations have with other bodies in the community, state, and nation, to learn the areas in which relative success or relative failure has occurred in these relationships, and to specify the ways in which particular points of view concerning optometry are expressed.

Organizations that are more or less official, other than the American Optometric Association and its constituent bodies, are the American Academy of Optometry, devoted largely to presentation of research papers on educational, professional, and scientific matters, and the Association of Schools and Colleges of Optometry, membership in which is limited to educational institutions. Concerns of the latter group include student support and recruitment, educational requirements, curricular

organization, relationships with state licensing boards, scholarships, qualifications of teaching personnel, post-graduate education, and the like. In his comprehensive appraisal of optometry, Hofstetter has described other organizations, following geographical as well as functional lines. Shared interests in education, professional problems, economic, political and legal aspects of optometry, research, fraternal ties, and public relations aspects of optometry appear to constitute the basis of affiliation in these additional organizations. Documentation is needed of the membership, activities and appeal of these and of other organizations, outside the "official family" of optometry, such as the Optometric Extension Program and the National Association of Optometrists. The relations of such groups with the official organizations, the segments of optometrists and other specialists who participate in their activities, the influence they have on different practices, and their points of contact with other institutions, deserve attention in any full examination of optometry and its status.

LEGAL BODIES

The legal bodies largely consist of the boards which are statutorily charged by the various state governments with the duty of protecting the public interest through the licensing of optometric practitioners.[25] Forty-eight states and two territorial jurisdictions are included. Statutory definitions of optometry are ordinarily provided as well as specifications and exemptions of those who must be licensed. By statute and by administrative regulation, such boards promulgate varying requirements for admission to licensing, such as, age, citizenship, state residency, educational background and examinations. The boards largely are limited to optometrists, although others are occasionally members. The boards often, with varying success, attempt to maintain standards of professional conduct among practitioners and to deal with activities of commercial organizations that provide competition or services judged non-professional. This function is shared somewhat with the voluntary professional associations. It would be a matter of some interest to study the shifting balance of performance and achievement involving the relative and the changing importance of state boards and voluntary professional associations. A full examination of many issues involved in the licensing of various occupations and professions with particular reference to the delicate balance between the interest and welfare of the public and that of the licensed occupation and profession is contained within Gellhorn.[26]

Regarding the state boards' function in licensing practitioners, it would also be a matter of exceeding interest to determine what subse-

quent careers are followed by that proportion of the prospective practitioners who fail to pass the state boards' examinations. In California, from July 1, 1952, to June 30, 1953, 22.1% of those taking the examination failed.[27] A number undoubtedly repeat the examination (in California it was recently proposed that four examinations be the limit, without evidence of additional satisfactory re-education); others may attempt to become licensed in other jurisdictions as a substitute. Possibly, as well, the failures include a number of optometrists licensed elsewhere who seek to change residence. In any event, some of the failing students undoubtedly drop out of the profession and seek alternative livelihoods. Which ones: opticians, dispensers, optical salesmen, or outside the field entirely?

ORGANIZATIONAL ENTITIES

The term organizational entities refers to the patterned ways in which the practitioner relates himself to other optometrists, to specialists of related fields, and to the public. As noted above, the usual procedure is for the optometrist to be engaged in independent practice, initially dependent on word of mouth procedures, later, on returning patients, and perhaps to some minor extent dependent on referrals from other practitioners. The optometrist may develop relationships with ophthalmologists as well as with other medical specialists to whom he refers patients who require examination of ocular pathologies. Inasmuch as extensive changes appear to be occurring in the United States in the health field, these organizational relationships may be changing. Attention has been directed recently to the development of pre-paid and insurance plans of group care and health centers, where optometrists may or may not participate with other specialists in inter-professional relationships. These shifts in the structural context of optometry, to the extent that they are occurring in various settings, may touch off significant changes in optometric practice, so that it is less typically an independent practice. Changes in professional practices of specialists clearly have resulted when this has occurred in the past in other professions such as in nursing and medicine, and, it may be anticipated, would likely occur in optometry.

This, then, is a very broad outline, sketched in familiar terms, of the institutional structure of the profession of optometry as it now appears to exist. Many details are omitted. Consideration of the diverse sociological and historical processes that have contributed in many ways to the development of this institutional structure is lacking. Little attention has been paid the relationships of this structure and of its component parts to other structures, groups, and personnel having dif-

ferent characteristics and functions. Any sociological overview of optometry must include the relationships between that profession and other professions on all levels of the structure. These relationships exist for the practitioner, for the voluntary association composed of practitioners, for the educational organizations, for the legal bodies and for the organizational settings within which the practitioners function. In this light, we refer to the profession of optometry in terms of horizontal relationships of different parts of its structure with homologous units of entities external to it, units of government and of other professions. In the subsequent portion of this paper, the major context will be the internal structure of the profession and the inter-related functioning within that structure of the different components. In particular, we shall be concerned with the practitioner and his behavior in relationship to the other units of his profession and his participation within them. That very complicated picture needs to be supplemented by detailed consideration of relationships between the practitioner and the community, including the patterned interactions between optometrist qua optometrist and optometrist qua citizen. In various degrees and in different ways the type of work performed and the attitudes expressed toward work and toward patients may affect the behavior of the optometrist in the community, and his dealings with persons of varied social backgrounds. At the same time, community participation by the optometrist may affect his practice and influence his relative success or failure and his estimate of his own professional stature.

Questions such as these derive from a sociological as well as from a social psychological appraisal of the profession of optometry. In the former case, the emphasis is on relations between social organizations and groups existent in the profession. In the latter, the emphasis concerns the practitioner himself, with attention on his attitudes and his motivations and the factors that affect them at various stages of his career. A comprehensive perspective incorporates both these orientations as frameworks for understanding the complexities of the social behavior of the optometrist as a person with specialized training offering his services to the community in an age of specialization and of change.[22]

INSTITUTIONAL STRUCTURE, CHANGE AND THE PRACTITIONER

With these views in mind, it is appropriate to raise a number of questions concerning the consequences of the institutional structure for the optometrist as a practitioner. In specific terms, how do changes in the relationships between the component parts of the structure affect the perspectives of the practitioner, and create or solve some of the problems he faces in his professional career?

(1) Changes may occur in the scope of work activity believed by optometrists to be the prerogative of optometry. These changes may affect the behavior of the individual optometrist and his relations both with the public and with other practitioners. For example, new procedures, such as prepaid visual care, as well as technical and scientific innovations, may come to be adopted by some members of the profession. In what ways do these bring about changes in the public's perception of the profession as a whole? When changes such as these occur, it may be expected that some practitioners will feel threatened and others perhaps challenged by them. Some may adopt them more rapidly than others. Research in at least one other profession has shown that rapid adopters of technical innovations differ in significant sociological respects from less rapid adopters or resisters. In a study of physicians' adoption of drug innovations,[28] it was found that adopters were more likely than non-adopters to be tightly integrated into the informal group of physicians in the community. Would a similar pattern be found in optometry? One might expect differences in such acceptance depending upon the presence or absence within a community of related specialists, such as ophthalmologists, and upon other factors as well.

(2) It would be of some interest to learn whether or not behaviors practiced by optometrists are affected, and if so, in which ways, by the development of persistent relations between dispensing opticians and ophthalmologists. It would be especially worthwhile to study this in process of change, by appropriate before-and-after studies. Relations in general with other professions are worth consideration. To what extent do optometrists and ophthalmologists refer patients to each other? Where joint participation in community health surveys, such as child vision studies, occurs, what accounts for it? Is this type of cooperation more or less likely to occur in small communities or neighborhoods or in larger cities? Differences in cooperative endeavors may reflect the nature of the issues involved, with possibly more cooperation occurring when local problems are faced by individual practitioners, and less cooperation occurring on broader issues, such as licensing legislation, and participation by optometrists in military service, where the state and national professional associations are implicated. The record of attempts by optometrists and by optometric associations to express points of view to other professions may reveal differences in the cordiality of response at different times and with different groups. It would be of great interest to develop a full documentation of this record of relationships.

(3) Analysis of trends toward professionalization in other fields has usually pointed to two different kinds of situations that are associated with this tendency.[29] In one situation an existing work group hopes to enhance its stature by acquiring additional work tasks that appear to be more demanding and honorific, at the same time dropping older activities that may appear unnecessary or perhaps degrading. A good illustration is the nursing profession. Secondly, older activities, perhaps scattered among different occupations, are reorganized by a new group composed initially of persons of diverse backgrounds. Cases in point are public relations and adult education. Optometry seems to represent a third type, one in which a profession with rather old claims to some degree of monopoly regarding particular work functions appears to be threatened in significant respects with claims to a somewhat similar area of work expressed by a branch of another highly respected profession. Responses to this situation may include the adoption of retaliatory procedures, for example, in connection with skirmishes at state legislative hearings when changes in licensing procedures are proposed. The threatened group may also attempt to bolster its position by engaging in such varied activities as public relations programs, educational workshops, the formation of research and scientific associations, and the like. The latter have the function of reiteration of the status of the field as a profession, if not to the satisfaction of the outside professsion, then at least to the satisfaction of the threatened field's own practitioners, and, they hope, to the satisfaction of the public. Interest in further professionalization may occur as a part response to the perception of external threats in the hope that the threat may thus be minimized. Still another response may be an attempt to develop and intensify affiliations with additional outside groups, from which they hope to derive recognition, and possibly support. Programs to relate optometry with various activities in the schools and in lodges and fraternal orders appear to suggest this. Both individual practitioners and professional associations may engage in these behaviors. The extent and nature of these activities, as well as the articulation between such activities by practitioners and by professional associations, might reflect the degree to which these entities perceive themselves to be marginal and deserving of more extensive recognition from the public, from other work specialties, and from particular institutions, governmental, and otherwise.

(4) What attitudes concerning optometry are brought to it by students? How are these attitudes modified by the exposure of students to the culture of the educational institutions, to the emphasis of the curriculum, to the beliefs of other students, and to the thinking of the

faculty? Some students may enter optometry training with the idea that it is a business like any other, and that while certain techniques have to be learned there is but little of a professional character to it. Others may view it as a profession. How do these different groups of students become socialized and learn to accept portions, at least, of the attitudes of their peers and teachers, if such attitudes differ from their pre-conceptions? Research on the relationships among general social values, particular types of occupational choices, the time of decision, and frustration patterns characteristic of different occupational goals, has taken place, especially for students,[30] with scanty reference, however, to those specializing in optometry.

(5) These studies of occupational choice clearly raise questions concerning the types of individuals recruited to optometry. Do parents with extensive educational achievements send to optometry fewer sons than one would expect in terms of the size of the group in the population at large? It may be that optometry serves as a stepping stone toward status by sons of lower middle class groups in small towns and cities. It would be worthwhile to determine how much of this occurs and what values and attitudes, associated with the community groups from which prospective optometrists come, effectively continue in their thinking once they are in practice.

Are there social characteristics that distinguish those who have an early interest in optometry which is followed through ultimately by entrance in an optometry school, from those whose initial interest does not eventuate with a decision to enter optometry training? What social and personal factors are related to the time at which prospective optometry students make the various decisions in the complex sequence necessary for ultimate entrance, and finally completion of training? A matter of some significance for the field of optometry concerns the presence of alternative careers. The students whose first love was always optometry, and who may be following fathers' models, would be expected to differ in their perceptions of optometry from those who really would have preferred to enter another field. Further along in the career process, which individuals become routed into career patterns with differing degrees of success and failure, or become located within communities of different sizes, or within different settings of private or corporate practice?[31] Some optometry graduates may become quite successful professional practitioners, while others may become commercially oriented advertisers and price cutters, whereas still others may enter corporate practice. Are the latter simply to be accounted for in terms of these men being the less successful students with poorer grades? Do

they originate in lower status levels from which they derive professional aspirations that differ from those of higher status groups which may be more receptive to fully professional norms? Are the so-called commercial optometrists more likely to be selected from groups more exposed to business practices and ethics? Are they likely to be the individuals who compare themselves, with unfavorable social and psychological conclusions, to medical practitioners, and deduce that it is difficult to compete on equal terms?[32]

(6) Another area concerns relations optometrists have with patients. A number of different questions can be asked. From which groups in the community are patients drawn? Are there differences in the status backgrounds of patients who visit optometrists and those who visit ophthalmologists? If there is a general tendency for members of particular status groups to visit optometrists, what kind of treatment does the optometrist accord to the exceptional patients, perhaps those from high status groups in the community? For such persons, do optometrists tend to describe and to provide services in terms different from those employed for typical patients? Explanations offered of the basis for fees may differ. Optometrists may distinguish between professional fees and material costs in different ways depending upon their perceptions of the identity of the patient. In similar fashion, older, possibly more affluent or more professionally minded practitioners, may discuss this matter with various categories of patients in manners quite different from those presented by optometrists in other career situations. The rhetoric presented to patients may vary systematically in relation to other factors, still to be identified. Is an optometrist more or less likely to describe the basis of his fees as the "cost of the spectacles" if his clientele is mainly transient, rather than residential? Other determinant factors may include community size, the degree of competition from other optometrists or the presence of well-developed ophthalmologist-optician relationships.

(7) Related questions pertain to the images that the public has of optometry and of optometrists. How are they viewed in the community: as doctors and physicians, as specialists in their own right, as store owners, as businessmen? When the general public and different segments of the public look upon optometrists, are they perceived as professionals? What activities are optometrists believed to perform? What kinds of persons are they thought to be? Conceivably, more highly educated persons have a different view of optometrists than persons with more limited exposure to divergent outlooks. The images of patients may be expected to differ from those of non-patients. Such

differences in beliefs, no matter how unfortunate and improper from the point of view of optometrists, may partially account for the variations in the readiness of different parts of the public to turn to optometrists when in need of visual care.

In addition to these questions pertaining to the public's image of optometrists' work functions, one may ask how much prestige is accorded to the optometrist both by the public in general and by particular special groups within the public. In varying degrees, occupational specialists are accorded positions in the general social order by the public. Some, such as physicians and supreme court justices, are assigned high rank and there is much agreement about that placement; others consistently are given low prestige, as, for example, street cleaners. Optometrists may be one of those many specialties for which there is imperfect agreement about prestige, although generally it may rank somewhere in the middle.[33]

(8) Still another aspect of the practitioner-public relation concerns participation in community affairs, to which we have alluded above. If optometrists participate in varied community activities, as seems likely, does this participation and the optometrists' interest in these reflect their concern regarding the public's uncertain acceptance of them as professionals? If a dilemma regarding status occurs, do optometrists utilize relationships with the public as opportunities for re-emphasizing, or, as Hofstetter phrased it, "reiterating" their professional stature? An alternative is for this participation in community activities simply to be associated with the position of optometrists in their communities, as professionals who are members of middle or upper-middle status groups and who are in relatively comfortable circumstances. Regardless of the functional circumstances which condition these behaviors, one may ask what consequences for the public's images of optometrists, and for their reputations, result from such activities. Finally, it does appear that optometrists who perceive themselves and their professions to be rather well accepted by the general community may engage in community activities with more personal assurance, and possibly less concern about the outcome, than those optometrists who perceive themselves as marginal and limited in general community acceptance.

(9) What are the relationships between participation in the activities of professional associations and the optometrists' work behaviors? Do different degrees of participation, and of expression of concern regarding the activities of such associations, characterize those optometrists who accept a definition of themselves as professionals in contrast with those who perceive themselves to be businessmen? It

would be expected that leaders in professional associations would have orientations toward optometry different from those who are active members, and that these in turn would not be identical with the orientations of persons who maintain nominal membership or of those who do not participate at all. Membership in different types of professional associations might also reveal such relationships. What are the career orientations of those who participate actively in the American Academy of Optometry, in contrast to those attracted to the Optometric Extension Program? Similarities as well as differences are likely, for these and for other associations as well. Persons active in the affairs of state associations might be expected to differ from those active in national as well as in local associations. Along other lines, questions may be asked concerning what have been called the "politics" of the professions. These largely pertain to the power relationships among different component units of any profession, such as the following: between state and national associations; between associations of practitioners and associations of training institutions; between research or educationally-oriented associations and commercially, possibly owner-oriented, associations; between practitioner associations and supplier associations; between state professional associations and licensing boards. The abilities of these organizations to express points of view that are coercive relative to others or to individual practitioners may reflect the extent of support and the degree of consensus that obtain among their respective memberships as well as the economic resources that they command and the institutionalized relationships that support their position within the profession.[34]

(10) Finally, questions may be raised concerning what have been called "colleague relations."[35] What channels are available to optometrists within a particular community if they perceive the need to control or to modify the behavior of a colleague? Since optometry is largely engaged in by individuals in private practice, and since specialized institutions, such as hospitals, are not present whereby particular practitioners can be rewarded or penalized by the extension or withdrawal of privileges to practice and to specialize, controls need be largely informal. An optometrist may appear to his colleagues to be stepping out of line with accepted professional practice on matters such as fees or regarding prescription procedures or relations with opticians and ophthalmologists, or relating to patient solicitation during industrial and school vision programs. Appeal to the sanctions of the state licensing agency may not be considered appropriate, perhaps not desirable or, in fact, not available. If this is viewed to be the situation, what recourse remains?

Do older practitioners attempt to modify the thinking of newcomers to the community or to practice, and if so by means of which techniques? How successful are these? What occurs when resistance and refusal to accept informally expressed suggestions result? Sanctions will be applied, it may be expected, whenever a practitioner deviates from standards accepted in his community by his colleagues, whether these standards are those that can be referred to as "professional" or "ethical," on the one hand, or, on the other, are those which may be called "commercial" or "business-oriented." Cleavages no doubt exist in optometry as they do in other professions concerning the practices that are acceptable. Deviations from preferred procedures are always tolerated up to a point which varies according to the perspectives of the group that is involved. The content of the norm, the extent of permissable variation, the modes of sanctions levied against those who deviate, and the responses of those who are penalized for deviancy or rewarded for conformity, as well as the kinds of punishments and rewards available for distribution by the group upholding the norm, remain to be specified.[36]

Impressions of optometrists and of their practice suggest that the institutional conditions of the profession confront them with what sociologists refer to as "role strains" or incompatibilities of expectations. Such incompatibilities involve patterned situations, recurrent in the behavior of specialists of different kinds. In particular circumstances, patients may make requests or express demands to optometrists that depart from the behaviors that optometrists themselves feel trained and qualified to meet. The values and beliefs that optometrists have learned and which they incorporate in their thinking may encourage them to relate themselves to patients as specialists providing services for a fee. At the same time, patients may communicate with optometrists on the assumption that the latter are selling a commodity and that prices are negotiable. Another example pertains to the types of perspectives optometrists utilize as basis for their behavior in the community. Optometrists' claims to their field of work are countered by the co-existence within the community of other specialists who make similar claims. Such a situation, were it to occur in any field of work with sets of practitioners of divergent trainings and orientations, would likely constitute a basis for the perception of threat. Parallel circumstances concern the fields of psychology and psychiatry, although there is a significant difference. In that situation, psychiatry, which is the challenged field, not only claims historical priority to the area of work behaviors in dispute but, as a branch of medicine, enjoys greater prestige than psychology.[37] Similar disputation has implicated ministers and funeral directors.

Incompatibilities or role strains may occur in connection with the sequence of expectations associated with the timing and series of choices made at different points of the career of the optometrist. Given the prediction that income will rise at a slowly ascending rate and then reach a plateau during the early years of practice until referrals and returns push income returns and expectations higher, certain optometrists may find that their own income does not conform to this pattern. The outcomes may be diverse. One may be a redefinition of expectations to a more realistic level. Another may lead to a relocation, if possible, in another community or another neighborhood in the hope of a fresh start. Such concern might also lead to a rethinking of professional behavior patterns along lines that appear to promise more extensive rewards. In another vein, the optometrist's view of himself as a reputable professional with appropriate prestige may be unmatched by the judgments that he believes others in the community have of him. Sensitivity to negative evaluations of such groups as ophthalmologists, community leaders, and the like, possibly may be associated either with conforming or with compensatory reactions both in professional and in non-professional areas of competency. Shifting contexts of opportunity and acceptance in the communities may, as well, require shifts in expectation on the part of the fledgling optometrist. Encouraged to believe the completion of optometric education will mean a start as an independent practitioner, he may find the difficult realities of practice can be resolved more easily, at least for the short run, by partnership or by salaried employment. Adjustments of this sort, as well as adjustments to new fads and fashions in the visible object which the public, although perhaps not the optometrist, conceives to be the end-product of the optometrist's work, may necessitate reorientations to self and to work that are easily acquired by some but not by others.

It would appear then that the role of the optometrist in regard both to his work and social behaviors may incorporate elements that are somewhat disjunctive. These are resolved in practice in manners that may be both preferred as well as non-preferred from the point of view of selected professional leaders. The extent to which these or other elements constitute significant and characteristic features of the activities of individual optometrists, of specific groups of optometrists, and of the profession as a whole, remains, of course, to be determined by actual empirical investigation. Research techniques including interviewing, opinion surveys and questionnaires, observation procedures, sociometric techniques, and the like, need be applied to the task of gathering the information necessary to support or to refute these in-

ferences. Until this is done, much of this remains suggestive and hypothetical rather than definitive and conclusive.

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EYE CONDITIONS IN HYPOTHYROIDISM*

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While collecting data for a study of learning variations among children with endocrine disorders a question was raised as to whether there might be a characteristic eye syndrome among hypothyroid cases.

This was investigated by forming a hypothyroid group of 20 cases and studying their eye manifestations as disclosed by a regular eye examination. These cases were compared with a group of 100 cases of approximately the same age who had no thyroid deficiency. Care was taken that these controls were free from all endocrine disorders as well as the one being investigated.

The median age of the hypothyroid cases was 9-11 while that of the control group was 10-0. The hypothyroid group presented a median Basal metabolic rate of —25, which was 10 points *below* the lower limit of the generally accepted normal range of plus 15 to minus 15. As would be expected in such cases the median serum cholesterol was elevated above the median of the control group (42mg% higher). Median temperature was a little more than half a degree below that of the controls, median pulse rate was 27 beats slower than the median of the other group, while the median respiratory rate was 6 respirations below that of the controls.

These variations are fairly typical of hypothyroid cases. The Basal metabolic rate is usually lowered, while the serum cholesterol is elevated. The temperature tends to be lower than the average and both pulse and respiratory rates tend to be slowed. See Table 1.

There were no consistent external or ophthalmoscopic signs in either group. The eye comparisons were remarkably alike except for the median speed of visual perception which appeared markedly retarded among the hypothyroid cases. Median visual acuity was the same in both groups and the median refractive measurements were only .12 D. apart. Median values for muscular balance at 20 feet and at the reading distance differed only slightly within 1 prism diopter.

The speed of visual perception was measured with a tachistoscope and by a method previously described by this author.[1] It consists of

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[1]Eames, T. H. The Speed of Picture Recognition and the Speed of Word Recognition in Cases of Reading Difficulty. American Journal of Ophthalmology 21: December, 1938, 1370-3.

TABLE I

Comparison of Medians in Hypothyroid and Non-Endocrine Cases

	Hypothyroid group	Group without endocrine difficulties
Age	9-11	10-0
B.M.R.	—25	+15 to —15*
Serum Cholesterol	208	166
Temperature	98.0	98.6
Pulse	63	90
Respiration	18	24
Visual acuity	20/20	20/20
Refraction	+.62	+.75
Coordination		
Distance	0.50 PD Exophoria	0.026 PD Exophoria
Near	1.00 PD Exophoria	0.961 PD Exophoria
Speed of Visual Perception	0.0100 second	0.0033 second

*Average normal range. B.M.R. tests were not required of the controls since they were all patients with no endocrine symptoms and signs.

the use of a projector fitted with a variable speed shutter through which pictures of familiar objects are flashed at book distance. Starting with the highest speed, the shutter is slowed with each exposure until the patient can see, recognize and report correctly the object depicted in the flash.

The highest speed at which this can be done is the measure of the speed of visual perception. It has been found that there are likely to be numerical differences in the measurement of the speed of perception with different instruments as well as when the tests are made at different object (screen) distances, with consequent differences in the size of image and intensity of illumination. For this reason the fact that here *was* a difference between the median measurements of the hypothyroid and non-endocrine controls is more significant than the specific numerical values. The extent of the difference, however, is of somewhat more importance.

The slower speed of visual perception among the hypothyroid cases is consistent with their characteristic slowing up with decrease of the basal metabolic rate. It is important to the practitioner since a retarded speed of visual perception will increase the length of time required to read a given amount of material. School children with this condition are likely to be unable to complete their assignments on time. There is also the hazard of slower seeing in traffic and the use of machinery. Corresponding handicaps among adults may be expected when hypothyroidism exists.

The use of spectacles and orthoptics is unlikely to increase the speed of visual perception appreciably in hypothyroid cases since the cause is in a lack of sufficient thyroid hormone. This will account for some

of the cases of slow speed on the tachistoscope which do not respond fully to correction of refraction or short exposure exercise.

The cases which make a good response to medication usually pick up speed in seeing without other treatment, somewhat in proportion to the return of the basal metabolic rate to normal.

Hypothyroid cases with slow speed of visual perception should not be confused with cases of slow speed of word perception, due to educational rather than endocrine causes. When both hypothyroidism and reading handicaps coexist, medical treatment of the hypothyroidism may result in an improvement in the speed of visual perception for objects, but the speed for word perception will tend to change little until adequate remedial reading assistance has been given. Briefly, medication can not take the place of instruction.

Exercises for the improvement of the speed of visual perception are in order when there is no demonstrable physiological or pathological cause for the retardation. When the speed of visual perception for words is slower than the speed for objects, short exposure exercises in word perception, best correlated with the daily school work, often result in improvement up to the level of the speed of perception for objects.

ANNOUNCEMENT

BRITISH OPTICIANS ACT APPROVED

On July 7 the British Opticians Act of 1958 received Royal Assent conferring statutory recognition and registration, similar to that of the medical and dental professions, upon some 7,500 ophthalmic opticians (optometrists) and 800 dispensing opticians in England, Scotland and North Ireland. The Act provides for the establishment of a General Optical Council composed of 24 persons with the object of promoting high standards of professional education and conduct among optometrists and opticians. In addition the particular functions of the Council will include (1) establishment of registers of qualified ophthalmic opticians and dispensing opticians and laying down conditions of admission to and removal from these registers. (2) Control of education and examination of entrants to the profession, and (3) setting up of investigating, disciplinary and educational committees. Clauses prohibit sight-testing by anyone who is not a registered ophthalmic optician or a medical practitioner.

THE EFFECT OF VISUAL TRAINING UPON THE ACA RATIO*

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INTRODUCTION

The ACA ratio is the name commonly used for the accommodative-convergence accommodation ratio. The ACA ratio designates the change in convergence per unit change in accommodation. It has been commonly designated a constant for a particular individual.[1, 2, 3] Hirsch[4] has defined biological constancy as, "A constant function is one which does not change in a systematic fashion." If we use the method of Fry[5] to calculate the ACA ratio, we have:

$$\text{ACA Ratio} = \frac{15 - \text{No. 8} + \text{No. 13B}}{2.50} \quad \ldots \quad (1)$$

Where, No. 8 = induced phoria at far
No. 13B = induced phoria at near

$$\text{or ACA Ratio} = 6 - \frac{(\text{No. 8} - \text{No. 13B})}{2.50} \quad \ldots \quad (2)$$

It is universally recognized that neither the induced phoria at far or the induced phoria at near are constants. These two optometric tests are considered as variables. Therefore, if the constancy of the ACA ratio is to be maintained this difference between the two phoria tests must remain constant. It is the common experience of those engaged in visual training that the nearpoint phoria is more amenable to change than the farpoint phoria. If this is true, we would expect that the difference between these two phoria test values would be different in magnitude after a series of visual training sessions.

Morgan[6] reported upon the effect of visual training upon optometric tests as follows, ". . . Some 50 subjects over a period of several years have been given intensive training while some 50 others have been given training but not so intensive. These subjects were matched in groups as near as possible and different lines of approach to the problem were tried. A control group receiving no training was also set up. The methods used are too varied to be discussed in a paper such

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as this except to say that at least one group received every type of published technics that the writer could find from the palming and other methods advocated by Bates to the elaborate methods described in the O.E.P. monthly literature.

"The findings that can be altered in order of ease in performing the alteration are shown:

1. Positive Fusional Convergence
2. Positive Relative Convergence
3. Adduction
4. Negative Fusional Convergence
5. Positive Relative Accommodation
6. Negative Relative Convergence
7. Abduction
8. Negative Relative Accommodation*
9. Additional Convex Lens Power to Perceptible Blur at Distance*
10. Fusional Supplementary Convergence*
11. Phoria*
12. Amplitude of Accommodation*
13. Monocular Cross-Cylinder*
14. Binocular Cross-Cylinder*

*In some instances the amount of change in function was definitely limited. These are marked with an asterisk. For example, F.S.C. contains generally some convergence brought about by the stimulus of nearness. This amount could be varied to almost any amount ranging from 0 to 10 or more prism diopters, but the basic amount depending on accommodative-convergence was not altered permanently in a single instance. Likewise, in the case of the phoria a change of some ± 2 diopters could be made in tonus and in addition a certain amount of willed convergence could be temporarily associated with this. . . ."

The term, Fusional Supplementary Convergence used by Morgan, is synonymous with the Induced Phoria at Near. Thus, in the table presented by Morgan, the nearpoint phoria test magnitude is more readily changed than the phoria (at far) test. Thus, the net effect of visual training should be a change in the ACA ratio which depends upon the difference between these two magnitudes.

In a previous paper[7] one of the factors presented which indicate the inconstancy of the ACA ratio was the change found in the ACA ratio after visual training based upon the case examples included by Lyle and Jackson[8] in their textbook. Table 1 includes the phoria values found at far and at near, before and after training by Lyle and

TABLE 1

Effect of Visual Training upon the ACA Ratio

(Based upon case examples—Practical Orthopedics—Lyle & Jackson[8])

Before Visual Training			After Visual Training		
Farpoint Phoria	Near Phoria	ACA	Farpoint Phoria	Near Phoria	ACA
8 Eso	14 Eso	8.4	14 Eso	11 Eso	4.8
5 Eso	5 Eso	6.0	4 Eso	5 Eso	6.4
1 Eso	4 Exo	4.0	1 Eso	4 Exo	4.0
1 Eso	2 Exo	4.8	1 Eso	1 Exo	5.2
Ortho	2 Eso	6.8	Ortho	2 Eso	6.8
8 Eso	7 Eso	5.6	7 Eso	7 Eso	6.0
1 Eso	2 Exo	4.8	1 Eso	Ortho	5.6
2 Eso	4 Eso	6.8	1 Eso	4 Eso	7.2
8 Eso	5 Eso	4.8	4 Eso	5 Eso	6.4
16 Eso	12 Eso	4.4	11 Eso	10 Eso	5.6
Ortho	4 Eso	7.6	Ortho	2 Eso	6.8
10 Eso	9 Eso	5.6	6 Eso	3 Eso	4.8
6 Eso	3 Eso	4.8	5 Eso	3 Eso	5.2
7 Eso	7 Eso	6.0	3 Eso	7 Eso	7.6
5 Exo	18 Exo	0.8	1 Exo	2 Exo	5.6
6 Exo	22 Exo	—0.4	3 Exo	4 Exo	5.6
1 Exo	14 Exo	0.8	1 Exo	13 Exo	1.2
Ortho	10 Exo	2.0	Ortho	1 Exo	5.6
2 Exo	6 Exo	4.4	Ortho	Ortho	6.0
2 Exo	16 Exo	0.4	1 Exo	2 Exo	5.6
2½ Exo	16 Exo	0.6	2 Exo	3 Exo	5.6
2 Exo	8 Exo	3.6	1 Exo	6 Exo	4.0
Ortho	13 Exo	0.8	1 Exo	9 Exo	2.8
7 Exo	8 Exo	5.6	½ Eso	Ortho	5.8
Ortho	18 Exo	—1.2	½ Exo	14 Exo	0.6
3 Exo	7 Exo	4.4	1½ Exo	Ortho	6.6
7 Exo	22 Exo	0.0	Ortho	Ortho	6.0
3 Exo	9 Exo	3.6	Ortho	Ortho	6.0
½ Exo	5 Exo	4.2	½ Exo	1 Exo	5.8
3 Exo	13 Exo	2.0	1 Exo	2 Exo	5.6
6 Exo	14 Exo	2.8	1 Exo	5 Exo	4.4
3½ Exo	2 Exo	6.6	6½ Exo	2 Exo	7.8
1 Exo	8 Exo	3.2	Ortho	3 Exo	4.8
Ortho	2 Exo	5.2	Ortho	2 Exo	5.2
1 Exo	5 Exo	4.4	1 Exo	3 Exo	5.2
2 Eso	1 Eso	5.6	2 Eso	½ Eso	5.4
1 Exo	3 Exo	5.2	1 Exo	3 Exo	5.2
1 Exo	15 Exo	0.4	1 Exo	2 Exo	5.6
Ortho	2 Exo	5.2	Ortho	2 Exo	5.2
1 Eso	2 Exo	4.8	1 Exo	2 Exo	5.6
Ortho	7 Exo	3.2	Ortho	7 Exo	3.2
Ortho	8 Exo	2.8	Ortho	8 Exo	2.8
1 Eso	2 Exo	4.8	1 Eso	1 Exo	5.2
Ortho	2 Exo	5.2	Ortho	2 Exo	5.2
1 Exo	10 Exo	2.4	1 Exo	3 Exo	5.2
Ortho	Ortho	6.0	Ortho	2 Eso	6.8
Ortho	4 Exo	4.4	Ortho	2 Exo	5.2
Ortho	Ortho	6.0	Ortho	Ortho	6.0
1 Exo	3 Exo	5.2	1 Exo	4 Exo	4.8
1 Eso	6 Exo	3.2	1 Eso	4 Exo	4.0
Ortho	Ortho	6.0	Ortho	Ortho	6.0
Ortho	6 Exo	3.6	Ortho	2 Exo	5.2

Continued on next page.

TABLE 1, continued

Before Visual Training			After Visual Training		
Farpoint Phoria	Near Phoria	ACA	Farpoint Phoria	Near Phoria	ACA
1 Eso	4 Exo	4.0	1 Eso	2 Exo	4.8
Ortho	Ortho	6.0	Ortho	Ortho	6.0
1 Exo	12 Exo	1.6	1 Exo	5 Exo	4.4
Ortho	Ortho	6.0	Ortho	Ortho	6.0
Ortho	4 Exo	4.4	Ortho	2 Exo	5.2
Ortho	10 Exo	2.0	Ortho	3 Exo	4.8
Ortho	1 Eso	6.4	Ortho	Ortho	6.0
½ Exo	6 Exo	3.8	½ Exo	6 Exo	3.8
1 Exo	2 Exo	5.6	Ortho	Ortho	6.0
4 Exo	2 Exo	6.8	4 Eso	4 Eso	6.0
½ Eso	6 Exo	3.4	Ortho	2 Exo	5.2
	Mean = 4.1			Mean = 5.3	
	Std. Dev. = 2.10			Std. Dev. = 1.23	

Sigma Difference = 0.307
$M_1 - M_2 = 1.2$
C.R. or "t" = 3.9

Jackson. From these phoria values, the ACA ratio was calculated by formula (1). The average ACA ratio prior to visual training was 4.1 with a standard deviation of 2.10 units; The average ACA ratio after visual training was 5.3 with a standard deviation of 1.23. Thus, two changes occurred in this sample of 63 cases with visual training: (1) There was a significant increase in the magnitude of the ACA ratio. (2) There was less dispersion of the ACA ratios after visual training.

Gibson[9] presents four non-strabismic case examples. From the phoria values given (see Table 2) the ACA ratio was calculated using formula 1. The data presented by Gibson are very interesting since we can calculate the changes in ACA ratio with continued training. In three of the four cases presented the ACA ratio increased in magnitude with training.

Heath and Hofstetter[10] in a case report concluded in part: "(1) The position of the phorias did not change throughout the course of training (with the exception of those instances in the early examinations where the entire zone or a portion of it shifted and narrowed due to a manifest strabismus), but the phorias showed much less variability as training proceeded. (2) The apparently high ACA ratio in the early examinations was a manifestation in some cases, of the variability of the phorias at that time, and in other cases was due to the shifting of the distance portion of the zone which accompanied the appearance of the squint. The observed change in slope of the phoria line may be attributed to the increased reliability and validity of the findings with training." In their summary they state in part, "The results of

TABLE 2

Effect of Visual Training upon the ACA Ratio
(Based upon case examples—Clinical Orthoptics—H. W. Gibson[9])

Case No. 5: Miss D.G., Age 24, Typist

Time	Far Phoria	Near Phoria	ACA Ratio
Initial	2 Exo	14 Exo	1.2
2 Weeks	2 Exo	10 Exo	2.8
3 Weeks	2 Exo	4 Exo	5.2
4 Weeks	2 Exo	3 Exo	5.6
8 Weeks	2 Exo	4 Exo	5.2

Case No. 6: Mr. L.H., Age 19, Clerk

Time	Far Phoria	Near Phoria	ACA Ratio
Initial	17 Eso	9 Exo	—4.4
4 Weeks	14 Eso	9 Eso	4.0
8 Weeks	10 Eso	6 Eso	4.4
12 Weeks	5 Eso	1 Eso	4.4
16 Weeks	1 Eso	2 Exo	4.8
20 Weeks	1 Eso	2 Exo	4.8

Case No. 7: Mrs. D., Age 25, Storekeeper

Time	Far Phoria	Near Phoria	ACA Ratio
Initial	1 Exo	12 Exo	1.6
2 Weeks	1 Exo	10 Exo	2.4
3 Weeks	1 Exo	8 Exo	3.2
4 Weeks	1 Exo	4 Exo	4.8
5 Weeks	1 Exo	2 Exo	5.6

Case No. 8: Mrs. H.D., Age 22, Draftsman

Time	Far Phoria	Near Phoria	ACA Ratio
Initial	1 Eso	1 Eso	6.0
2 Weeks	Ortho	1 Exo	5.6
3 Weeks	Ortho	1 Exo	5.6

nine clinical examinations of a patient exhibiting an intermittent alternating exotropia are presented in graphical form and are compared to a subsequent and more extensive determination of the zone of clear single binocular vision. These examinations show an apparent decrease in the ACA ratio, an apparent reduction of the distance exophoria . . . The apparent decrease in the ACA ratio and reduction of the exophoria are attributed to the disappearance of this stabismic shift of the zone and to the increasing reliability and validity of the findings with training. . . . The position, slope, and width of the zone remain essentially unchanged although the subjective and objective evidence of visual discomfort and the observed occurrence of an intermittent strabismus have been eliminated."

The strabismic patient described by Heath and Hofstetter started his visual training on March 23, 1949. It is reasonable to assume that after one and one-half years of training and eight visual examinations the patient would have a reasonably steady binocular state and be a reliable observer. The seventh examination of this patient was performed on October 27, 1950, by a member of the clinical staff who determined that the farpoint phoria was 8 Δ exo and the nearpoint phoria was 12 Δ exo. Approximately three months later, January 16,

1951, this patient was examined by a member of the clinic staff. The farpoint phoria at this time was now 9 Δ exo while the nearpoint phoria was 9½ Δ exo. If we use formula (1), we have: ACA Ratio on 10/27/50 = 4.4 and ACA Ratio on 1/16/51 = 5.8. This is an increase in the ACA Ratio of 1.4 units after approximately three months of binocular training. The data of Heath and Hofstetter would indicate that after a patient had been examined a sufficient number of times and a binocular pattern had been established, that further training results in an increase in the ACA Ratio.

EXPERIMENTAL

In order to determine the effect of visual training upon the ACA ratio all patients with binocular vision seeking visual training at the clinic of the Illinois College of Optometry during the 1956-1957 school year were used as our sample. Any such patient receiving twelve visual training periods and participating in the progress examination was included in the data of Tables 3 and 4. The visual training procedures

TABLE 3

The Frequency Distribution of the Induced Phoria at Far (#8) Before and After Visual Training

Cell Limits	Mid-Value	f (Before V.T.)	f (After V.T.)
29s — 27s	28s	1	
26s — 24s	25s	0	
23s — 21s	22s	0	0
20s — 18s	19s	2	1
17s — 15s	16s	2	0
14s — 12s	13s	3	2
11s — 9s	10s	5	4
8s — 6s	7s	4	6
5s — 3s	4s	15	19
2s — ortho	1s	68	53
1x — 3x	2x	63	86
4x — 6x	5x	19	22
7x — 9x	8x	12	2
10x — 12x	11x	2	1
13x — 15x	14x	2	2
16x — 18x	17x	1	1
19x — 21x	20x	0	1
22x — 24x	23x	0	0
25x — 27x	26x	0	
28x — 30x	29x	1	
		N = 200	N = 200

Before Visual Training
$M_1 = 0.35$ exophoria
$\Sigma_1 = 5.85\Delta$
$\Sigma M_1 = 0.41$
$\Sigma_{1\sigma} = 0.29$
$\Delta M = M_2 - M_1 = 0.24\Delta$
$\Sigma D_m = 0.51$
C.R. = 0.24/0.51 = 0.47

After Visual Training
$M_2 = 0.59$ exophoria
$\Sigma_2 = 4.41\Delta$
$\Sigma M_2 = 0.31$
$\Sigma_{\sigma 2} = 0.22$
$\Delta\Sigma = \Sigma_1 - \Sigma_2 = 1.44\Delta$
$\Sigma D_\sigma = 0.36$
C.R. = 1.44/0.36 = 4.0

TABLE 4

The Frequency Distribution of the Induced Phoria at Near (#13B) Before and After Visual Training.

Cell Limits	Mid-Value	f (Before V.T.)	f (After V.T.)
20s — 18s	19s	3	
17s — 15s	16s	0	0
14s — 12s	13s	4	3
11s — 9s	10s	9	4
8s — 6s	7s	7	14
5s — 3s	4s	9	13
2s — Ortho	1s	29	22
1x — 3x	2x	23	26
4x — 6x	5x	36	53
7x — 9x	8x	29	37
10x — 12x	11x	24	17
13x — 15x	14x	17	7
16x — 18x	17x	3	2
19x — 21x	20x	3	1
22x — 24x	23x	4	0
25x — 27x	26x	0	1
		N = 200	N = 200

Before Visual Training	After Visual Training
$M_1 = 4.25$ exophoria	$M_2 = 3.62$ exophoria
$\Sigma_1 = 8.01\Delta$	$\Sigma_2 = 6.36\Delta$
$\Sigma M_1 = 0.57$	$\Sigma M_2 = 0.45$
$\Sigma_{\sigma 1} = 0.40$	$\Sigma_{\sigma 2} = 0.32$
$\Delta M = M_1 - M_2 = 0.63\Delta$	$\Delta\Sigma = \Sigma - \Sigma_2 = 1.65\Delta$
$\Sigma D_m = 0.73$	$\Sigma D_\sigma = 0.51$
$C.R._m = 0.63/0.73 = 0.87$	$C.R._\sigma = 1.65/0.51 = 3.24$

were specifically prescribed by the visual training director. The training was administered twice weekly for a period of thirty minutes. The training consisted wholly of basic training procedures of monocular rotations, monocular fixations, and accommodative rock. In some instances unfused rotations, alternate fixations and fused fixations were used. Thus, these twelve training periods consisted of visual rehabilitation of the binocular pattern. The data for the induced phoria at far (#8) are presented in Table 3 and Figure 1. The data for the induced phoria at near (#13B) are presented in Table 4 and Figure 2. The mean value for the induced phoria at far (#8) shifted from 0.35 Δ exo. prior to visual training, to 0.59 Δ exo after visual training. The mean value for the induced phoria at near (#13B) shifted from 4.25 Δ exo prior to visual training to 3.62 Δ exo after visual training. In neither case were these changes significant (see bottom of Table 3 and Table 4).

The ACA ratio for each of the cases was computed by the method of Fry (Formula 1). These data are arranged in Table 5 and Figure 3. We found that the mean ACA ratio prior to visual training was 4.4 while the mean ACA ratio after visual training was 4.9. This difference of 0.5 units is significant at the 3% level.

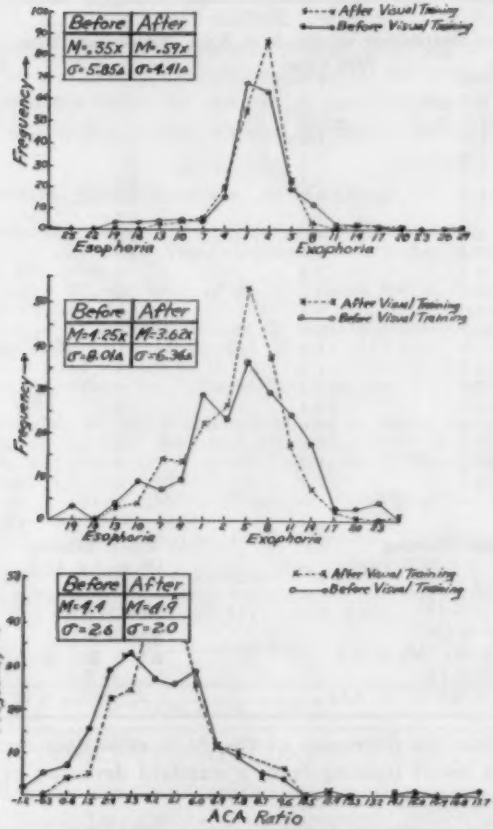

Fig. 1. (Top) The frequency distribution of the induced phoria at far (#8) before and after visual training.
Fig. 2. (Center) The frequency distribution of the induced phoria at near (#13B) before and after visual training.
Fig. 3. (Bottom) The frequency distribution of the ACA ratio before and after visual training.

CONCLUSION

In consideration of the data for the two hundred patients who received the most elementary type of visual training and the cases presented by Lyle and Jackson and Gibson, it can be concluded:

1. That the ACA ratio did change significantly with visual training.

2. That visual training tends to increase the magnitude of the ACA ratio.

TABLE 5

The Frequency Distribution of the ACA Ratio Before and After Visual Training.

Cell Limits	Mid-Value	f (Before V.T.)	f (After V.T.)
—1.6 — —0.8	—1.2	2	
—0.7 — +0.1	—0.3	5	0
+0.2 — 1.0	+0.6	7	4
1.1 — 1.9	1.5	15	5
2.0 — 2.8	2.4	28	22
2.9 — 3.7	3.3	32	24
3.8 — 4.6	4.2	26	42
4.7 — 5.5	5.1	25	45
5.6 — 6.4	6.0	28	25
6.5 — 7.3	6.9	11	11
7.4 — 8.2	7.8	9	10
8.3 — 9.1	8.7	5	4
9.2 — 10.0	9.6	4	6
10.1 — 10.9	10.5	0	0
11.0 — 11.8	11.4	1	1
11.9 — 12.7	12.3	0	0
12.8 — 13.6	13.2	0	0
13.7 — 14.5	14.1	0	1
14.6 — 15.4	15.0	1	0
15.5 — 16.3	15.9	0	
16.4 — 17.2	16.8	0	
17.3 — 18.1	17.7	1	
		N = 200	N = 200

Before Visual Training	After Visual Training
$M_1 = 4.4$ ACA ratio	$M_2 = 4.9$ ACA ratio
$\Sigma_1 = 2.6$	$\Sigma_2 = 2.0$
$\Sigma M_1 = 0.18$	$\Sigma M_2 = 0.14$
$\Sigma_{\sigma 1} = 0.13$	$\Sigma_{\sigma 2} = 0.10$
$\Delta M = M_2 - M_1 = 0.5$	$\Delta\Sigma = \Sigma_1 - \Sigma_2 = 0.6$
$\Sigma_{D\sigma} = 0.23$	$\Sigma_{D\sigma} = 0.16$
C.R. = 0.5/23 = 2.18	C.R. = 0.6/0.16 = 3.75

3. That the dispersion of the ACA ratio data decreased significantly with visual training from a standard deviation of 2.6 prior to training to 2.0 after training.

4. The nearpoint induced phoria (#13B) is more amenable to change than the farpoint induced phoria (#8). This verifies common clinical experience.

5. Since a constant function is one which does not change in a systematic fashion and since the data presented here does show that the ACA ratio shows a significant increase in magnitude after visual training, it can no longer be postulated that the ACA ratio is a unique biological constant.

SUMMARY

The results of two hundred binocular patients receiving visual training agrees with the data of Lyle and Jackson and Gibson: such training results in an increase in the magnitude of the ACA ratio. This

shift in ACA ratio indicates that the ACA ratio is not a unique biological constant but a calculated variable denoting the change in convergence per unit change in accommodation at the moment. In many cases, this calculated value has remarkable stability similar to the stability of the phoria magnitudes we find for certain patients.

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ANNOUNCEMENT

SCHEDULED EDUCATIONAL CONTACT LENS MEETINGS

The following is a list of contact lens conferences and congresses scheduled for September, October and November, 1958.

Pittsburgh. Roosevelt Hotel. Second Eastern Optometric Contact Lens Conference. September 7-8.

St. Paul. St. Paul Hotel. First Northern Optometric Contact Lens Conference. October 12-13.

New York City, Roosevelt Hotel. Third National Contact Lens Congress. November 2-3. (Eastern meeting.)

Chicago. Sherman Hotel. Third National Contact Lens Congress. November 9-10. (Mid-West meeting.)

San Francisco. Sheraton - Palace Hotel. Third National Contact Lens Congress. November 16-17. (Western meeting.)

The meetings are open to all optometrists.

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PRESENTING A REVIEW OF ACADEMY POST-GRADUATE COURSES

A review of the 4th annual Academy post-graduate courses scheduled for all optometrists at Boston, December 10, 11 and 12, 1958, is presented on following pages. This exceptional collection of 55 courses, each given by an outstanding specialist in his subject, is the largest and we believe to be the finest example of post-graduate education ever offered the profession. These courses are offered under the supervision of Dr. V. J. Ellerbrock, Columbus, and his committee. They have hand-picked their instructors from our schools and colleges and from private practice and in so doing have again presented an array of talent entirely typical of Academy events. All optometrists are invited to take part. For most classes attendance is only limited by the size of the lecture rooms. In spite of this, advance registration is suggested.

CAREL C. KOCH

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

AMERICAN ACADEMY OF OPTOMETRY POST-GRADUATE COURSES

Statler-Hilton Hotel
Boston, Massachusetts
December 10, 11, 12, 1958

GENERAL INFORMATION ON POST-GRADUATE COURSES

Time: All courses are scheduled for the three days immediately preceding the regular annual meeting of the Academy.

Place: All of the courses will be taught in the Statler-Hilton Hotel.

Applicants: Any optometrist may apply for one or more courses. However, Academy Fellows have preference in advance registration until September 24, 1958.

Cancellation: In case of cancellation by applicant the fee will be returned, providing such cancellation is received no later than November 22, 1958.

Cost: The cost per hour of instruction is $2.00 unless otherwise specified.

Enrollment: For most courses the enrollment is not limited. Several specialized courses, however, are limited in enrollment as indicated in the description of courses.

Number of Courses: Fifty-five (55).

Hours of Instruction: One hundred and thirty-four (134).

Applications: All applications should be sent to Dr. D. G. Hummel, The National City Bank Bldg., Cleveland, Ohio.

Deposit: One-half the total fee for each course must accompany the application. The balance must be paid at the commencement of the courses. Courses limited in enrollment must be accompanied by the full fee.

Tickets: Without exception, everyone enrolled in a course must register and pick up the appropriate ticket. Without it, no one can be admitted.

Lecture Rooms: These will be posted at the registration desk. The hotel bulletin board will state the location of the registration desk. Please check your time schedule of courses. The Committee cannot be responsible for conflicts of scheduling.

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COURSE 1. Subjective Testing Procedures. Merrill J. Allen, O.D., Ph.D., Bloomington, Indiana. A two-hour course. $4.00 Periods: F-10, F-11.

A review of subjective test procedures used in an eye examination with special consideration of some frequent sources of error and causes of test failure. The following tests will be covered: visual acuity, binocular balance tests, astigmatism tests at distance and near, bichrome test and the effects of distance test criteria on near test findings.

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COURSE 2. Prism Prescription for Lateral Imbalance. Merrill J. Allen, O.D., Ph.D., Bloomington, Indiana. A one-hour course. $2.00. Period: F-2.

When and how to prescribe prism for relief of asthenopia due to lateral imbalance. The advantages and disadvantages of ophthalmic prisms will be discussed and simple rules for their effective use will be given.

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COURSE 3. Basic Principles in Fitting Prosthetic Eyes. H. R. Alton, Southbridge, Massachusetts. A two-hour course. $4.00. Periods T-12, T-1 (by invitation).

Principles of eye fitting for simple enucleation, enucleation with implant and evisceration.

KEY TO DESIGNATION OF PERIODS

Time	Wednesday	Thursday	Friday
8:00 A.M.	W-8	T-8	F-8
9:00	W-9	T-9	F-9
10:00	W-10	T-10	F-10
11:00	W-11	T-11	F-11
12:00	W-12	T-12	F-12
1:00 P.M.	W-1	T-1	F-1
2:00	W-2	T-2	F-2
3:00	W-3	T-3	F-3
4:00	W-4	T-4	F-4
5:00	W-5	T-5	F-5
8:00	W-E	T-E	F-E

Note: In program of Courses, (E) denotes 8:00 P.M. Evening Course.

Techniques in fitting plastic stock eyes, modifications, custom impressions and cosmetic cover lenses. The desired fit and cosmetic appearance of a finished prosthesis also will be considered.

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COURSE 4. Visual Training and Speed in Reading. Louis Anapole, O.D., D.O.S., Boston. A four-hour course. $8.00. Periods W-12, W-1, T-12, T-1.

Visual training techniques to improve reading habits: classroom reading materials for speed and comprehension and tachistoscopic training procedures for speed/span of recognition. Special reading films for improvement of speed and comprehension. Reading efficiency techniques (pre-reading, skimming, etc.) and progress tests for measurement of the degree of improvement. Home training procedures to augment class training sessions.

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COURSE 5. Accounting and Office Procedures. Otto J. Bebber, O.D., Denver. A two-hour course. $4.00. Periods F-E.

Methods of charging for professional service and recommended accounting practices to simplify tax and office procedures. The role of credit and methods for handling delinquent payments also will be considered.

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COURSE 6. Vision Care of Children. Lois Bing, O.D., Cleveland. A six-hour course. $12.00. Periods T-4, T-5, F-8, F-9, F-12, F-1.

Vision care of the pre-school child (2 hours); vision care of the non-achieving school child (2 hours); and vision screening of school children (2 hours). The instructor not only has experience from the actual practice of optometry but also as a teacher in the classroom; at present she is chairman of the Committee on Vision Problems in Children and Youth of the A.O.A.

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COURSE 7. Pathology of the Cornea. Arthur O. Bruce, M.D., Boston. A two-hour course. $4.00. Periods F-8, F-9.

Pathology of the cornea with emphasis on corneal abrasions and lesions of the cornea in relation to contact lens fitting. The instructor is a member of the faculty of the Massachusetts College of Optometry.

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COURSE 8. Absorptive Lenses. Harold Cline, O.D., Boston. A two-hour course. $4.00. Periods W-8, W-9.

Discussion of luminosity, response and transmission curves. Characteristics of various types of absorptive lenses. Factors warranting the prescription of absorptive lenses. Special cases and the selection of absorptive lenses for various purposes.

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COURSE 9. Review and Evaluation of Reminder Systems. Paul L. Connolly, O.D., Royal Oak, Michigan, and Milton Hathaway, O.D., Pontiac, Michigan. A one-hour course. $2.00. Period F-1.

Reminder systems have proven to be a very important part of many successful practices. The design of a number of the most popular ones will be explained in detail. This will include data on frequency of mailing, effectiveness, use of postage meter as well as use of other office mailings.

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COURSE 10. Signs and Symptoms of Aniseikonia. Paul L. Connolly, O.D., Royal Oak, Michigan. A one-hour course. $2.00. Period F-10.

Every new refractive correction produces changes in the ocular images and in conditions under which the patient sees. Whether these changes are clinically significant depends not only upon their magnitude but also upon the patient's tolerances and his psycho-physical characteristics. These factors will be discussed and evaluated in the light of several years' experience. This discussion will lead to helpful clues for suspecting aniseikonia as a possible cause of headaches, asthenopia, and other visual disturbances.

SCHEDULE OF COURSES BY HOURS

Hour	Wednesday	Thursday	Friday
8:00 A.M.	___ 8 33 ___	40 36 55 13	7 50 30 6
9:00 A.M.	___ 8 33 ___	40 36 55 13	7 50 30 6
10:00 A.M.	22 38 41 35	22 38 41 23	19 10 16 1
11:00 A.M.	22 38 41 35	22 38 41 23	17 42 16 1
12:00 Noon	___ 37 4 ___	24 3 4 26	21 42 ___ 6
1:00 P.M.	12 37 4 51	24 3 4 26	21 9 52 6
2:00 P.M.	22 38 41 31	22 38 41 46	48 27 14 2
3:00 P.M.	22 38 41 31	22 38 41 46	48 27 14 25
4:00 P.M.	53 45 54 29	47 32 49 6	20 32 49 44
5:00 P.M.	53 45 54 ___	47 32 49 6	18 32 49 44
Evening	34 28 15 11	34 28 15 11	39 5 43

COURSE 11. Streak Retinoscopy. J. C. Copeland, O.D., Chicago. A four-hour course. $8.00. Periods W-E, T-E.

This course is intended for those who wish to improve their skills in objective testing. Many innovations in teaching the Streak Technique will make the course of special interest to both those who now use the Streak Retinoscope and those who desire to begin its use. Each student will be provided with all necessary equipment including a retinoscope, schematic eye, transformer and lenses. The course is conducted so as to give each man personal supervision and instruction as well as lectures for the group.

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COURSE 12. Occupational Vision in the Army. Robert E. Eschbach, O.D., Captain, Medical Service Corps, Washington, D. C. A one-hour course. $2.00. Period W-1.

This course covers objectives of an occupational vision program in the Army and procedures for implementing such programs in Army installations. The instructor is well qualified to speak on this phase of optometry; at present, he is chief of the Occupational Vision Branch of the U.S. Army Environmental Health Laboratory.

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COURSE 13. Practice Management. Ramie B. Dick, O.D., Sandusky, Ohio. A two-hour course. $4.00. Periods T-8, T-9.

Records for a recall system, accounts receivable, and other office procedures will be discussed. The effective use of assistants, modern office techniques such as intercoms, postage meters, Todd-Hadley professionalman's accounts system, dictaphones, and similar aids also will be reviewed.

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COURSE 14. Occupational and Motorists Vision Program. Richard Feinberg, O.D., Ph.D., and W. Sherman, Petersburg, Virginia. A two-hour course. $4.00. Periods F-2, F-3.

Review and new considerations for optometrists participating in occupational and highway safety programs. Techniques of initiating and directing vision testing, visual efficiency and eye protection programs.

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COURSE 15. Sub-Normal Vision and Clinic. William Feinbloom, O.D., Ph.D., New York City, Irving P. Filderman, O.D., Memphis, and C. Edward Williams, O.D., Denver. A four-hour course. $16.00. Enrollment limited to 15. Periods W-E, T-E.

A combined lecture and clinic course designed to present and analyze problems of the partially blind patient. The application of visual aids in caring for these patients will be covered in detail.

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COURSE 16. The Physiological Optics of the Partially Blind Eye. William Feinbloom, O.D., Ph.D., New York City. A two-hour course. $4.00. Periods F-10, F-11.

The effect of pathology and abnormalities on the physiological optics of the normal eye. The material presented in this course will enable the practitioner to better screen, understand, and aid his partially blind patients.

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COURSE 17. Corneal Physiology and Contact Lenses. Isidore S. Finkelstein, O.D., Ph.D., New York City. A one-hour course. $2.00. Period F-11.

Effect of contact lenses on fluid and gaseous transport in the cornea, transparency, and turgescence. A review will be made of recent experimental findings but chief emphasis will be upon their clinical significance.

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COURSE 18. Clinical Aspects of Contact Lenses. Isidore S. Finkelstein, O.D., Ph.D., New York City. A one-hour course. $2.00. Period F-5.

Practical problems of magnification, effectivity, prismatic effects and binocular coordination. Particular attention will be given to problems with corneal lenses.

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COURSE 19. Evaluation of Quality in Ophthalmic Lenses. Glenn A. Fry, O.D.,

Ph.D., Columbus. A one-hour course. $2.00. Period F-10.

For several years the instructor has been Chairman of the Standards Committee of the A.O.A. and represents Optometry on an American Standards Association Committee on spectacle lenses. He will demonstrate methods of testing ophthalmic lenses for quality and show what defects cannot be permitted and how defects can be most readily detected.

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COURSE 20. Vision Discomfort—Role of Glare Sources and the Pupil. Glenn A. Fry, O.D., Ph.D., Columbus. A one-hour course. $2.00. Period F-4.

Under normal circumstances, the adaptive mechanisms to illumination include not only photochemical changes in the retina but also alteration in the size of pupil. Glare sources constitute a particular problem in adaptation due to the restricted size of retinal image. The role of such sources and the pupil in vision discomfort as well as the responsibility of the optometrist in providing relief will be considered.

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COURSE 21. Amblyopia. Ernest Giglio, O.D., Bernardsville, New Jersey. A two-hour course. $4.00. Periods F-12, F-1.

A major problem in optometric practice is the decision whether a patient with amblyopia can be helped. This course is designed to provide an up-to-date review of diagnostic procedures and of methods of training, with special emphasis on the probability of success.

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COURSE 22. Advanced Course on Corneal Lenses. Robert Graham, O.D., Pasadena, William Feinbloom, O.D., Ph.D., New York City, and Bernard Mazow, O.D., Houston. An eight-hour course. $32.00. Periods W-10, W-11, W-2, W-3, T-10, T-11, T-2, T-3. (Course limited.)

Techniques for maximum success in fitting modern corneal lenses; methods for securing optimum results in regular cases, as well as procedures employed in handling the more complicated and difficult problems. The course is for those who already have substantial experience in the fitting of corneal contact lenses.

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COURSE 23. Lighting Design for Effective Working. Sylvester K. Guth, E.E., D.O.S., Cleveland. A two-hour course. $4.00. Periods T-10, T-11.

It is commonly recognized that lighting plays an important role in visual comfort. For this reason, it is desirable that the practitioner be acquainted with basic principles of good lighting design. These principles will be covered together with recent experimental data in lighting; the availability and role of handbooks in lighting design also will be discussed and practical examples presented.

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COURSE 24. Optometric Participation in Community Health and Welfare Programs. Alden N. Haffner, O.D., New York City. A two-hour course. $4.00. Periods T-12, T-1.

Brief review of community health and welfare activity, public health activity and optometric responsibility in these fields. Discussion of relative needs for optometric care, indigent and otherwise, in various population segments will be covered. Financial support of such programs will be evaluated.

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COURSE 25. Color Deficiency in School Children. Gordon G. Heath, O.D., Ph.D., Bloomington, Indiana. A one-hour course. $2.00. Period F-3.

The effects of various types of defective color vision on early school performance. Screening tests for detection and diagnosis of important defects. Informing and educating parent, teacher, and child.

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COURSE 26. Haploscopic Testing of Binocular Vision. Gordon G. Heath, O.D., Ph.D., Bloomington, Indiana. A two-hour course. $4.00. Periods T-12, T-1.

Principles of the haploscope and its use in optometric examinations: measurement of refractive error, phorias, ductions, and accommodative functions. Demonstration of a recording haploscope designed for office use.

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COURSE 27. Screening of Visual Fields with Multi-Pattern Test Targets. Frederick W. Hebbard, O.D., Ph.D., Columbus. A two-hour course. $4.00. Periods F-2, F-3.

Discussion of multiple-pattern visual-field screening techniques using tachistoscopic presentation of target patterns by means of ultra-violet flashing. Consideration of advantages and limitations of such techniques, together with their validity and relationship to other methods of field testing. Demonstration of the Harrington-Flocks and Roberts screeners.

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COURSE 28. Ocular Pathology Review Organized by Section on Pathology, American Academy of Optometry. Monroe J. Hirsch, O.D., Ph.D., Chairman, Ojai, California. A four-hour course. $8.00. Periods W-E, T-E.

Members of the Section will participate during the 2 two-hour evening periods.

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COURSE 29. Multifocal Lenses for Anisometropic Patients. Monroe J. Hirsch,

O.D., Ph.D., Ojai, California. A one-hour course. $2.00. Period W-4.

Near vision tasks for anisometropic patients fitted with spectacles involves a number of problems connected with the unequal prismatic effect of lenses. Different approaches exist to the solution of these problems by purely optical means, but they cannot be discussed without reference to the individual patient's history and symptoms. This course is designed to study each of these aspects and to help the practitioner to attain a balance appropriate to the needs of the individual patient.

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COURSE 30. Practice Management for Better Inter-Professional Relations. H. W. Hofstetter, O.D., Ph.D., Bloomington, Indiana. A two-hour course. $4.00. Periods F-8, F-9.

Suggestions for facilitating efficient and effective referral, guidance, and advisory procedures in routine practice.

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COURSE 31. Differential Diagnosis of Myopia. J. Donald Kratz, O.D., Souderton, Pennsylvania. A two-hour course. $4.00. Periods W-2, W-3.

This course will review and evaluate the data supporting anatomical and functional concepts for the development of myopia. A guide for a differential diagnosis then will be developed. A detailed case analysis will be included to demonstrate the use of the guide in routine refractions.

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COURSE 32. Recent Developments in Ophthalmic Dispensing. Norman A. MacLeod, McLeod Optical Company, Providence, Rhode Island (by invitation). A four-hour course. $8.00. Periods T-4, T-5, F-4, F-5.

This course will emphasize the following subjects: Prescribing complete eyecare, how to dispense complete eyecare, how to dispense style in eyewear, the role of plastic lenses, optometry's part in dispensing hearing aids, and recommended dispensing techniques. The course is practical in nature and wherever possible actual demonstrations will be made.

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COURSE 33. Clinical Aspects of Ocular Motility. Marshall V. Mark, O.D., Boston. A two-hour course. $4.00. Periods W-8, W-9.

A discussion of the physiology and pathology of the extrinsic muscles. The presentation of various diagnostic techniques for investigating and evaluating the ocular motor apparatus.

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COURSE 34. Introduction to Slit Lamp Miscroscopy. Bernard Mazow, O.D., Houston. A four-hour course. $16.00. (Course limited to 8.) Periods W-E, T-E.

Anatomy of anterior segment of eye and mechanics of the slit lamp. Demonstration in use of the slit lamp. In the laboratory the participants will familiarize themselves with the mechanics of the slit lamp and will practice using the instrument on each other.

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COURSE 35. Turville Infinity Balance Test. Meredith W. Morgan, O.D., Ph.D., Berkeley. A two-hour course. $4.00. Periods W-10, W-11.

The Turville infinity binocular balance technique for determining the subjective refractive error of each eye while maintaining single binocular vision will be demonstrated. The utilization of this method, frequently referred to as the TIB technique in practice, will be discussed. The prescribing of base-in and vertical prisms will be described.

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COURSE 36. Unfavorable Prognostic Conditions in Strabismus. Meredith W. Morgan, O.D., Ph.D., Berkeley. A two-hour course. $4.00. Periods T-8, T-9.

The various anomalies which lead to an unfavorable prognosis in treatment of strabismus will be presented. Simple methods used to detect these anomalies will be described.

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COURSE 37. Adjusting Modern Ophthalmic Frames. Foster Namias, O.D., Boston. A two-hour course. $4.00. Periods W-12, W-1.

This course will be of a practical nature. The actual procedure will be demonstrated with sample frames and various pliers.

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COURSE 38. Modern Contact Lens Fitting. John C. Neill, O.D., Philadelphia. An eight-hour course. $32.00. (Course limited to 30.) Periods W-10, W-11, W-2, W-3, T-10, T-11, T-2, T-3.

A course dealing with the fundamental principles of fitting contact lenses so that the practitioner will be able to instruct a laboratory in the design of the lenses for a particular patient.

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COURSE 39. Prepaid Optometric Services. Henry B. Peters, O.D., M.A., Oakland. A two-hour course. $4.00. Period F-E.

The experience of California Vision Services in providing the first fully prepaid vision service to fourteen Unions. Professional services and ophthalmic materials have been supplied these groups for more than two years. Valuable information on utilization, rates, administrative problems, sales methods, etc., will be presented.

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COURSE 40. Communications in Eye Safety Programs. Henry B. Peters, O.D., M.A., Oakland. A two-hour course. $4.00.

Periods T-8, T-9.

The key role of communications techniques in the organization, promotion and operation of a successful voluntary eye safety program. Information dissemination and exchange is presented as an organized program utilizing many media: bulletins, notices, letters, schedules, meetings, personal contact, etc. The important central position of the industrial vision consultant is emphasized. Case histories are used to illustrate the problems and their solutions.

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COURSE 41. Subnormal Vision. William Policoff, O.D., Wilkes-Barre, Pennsylvania, and Alfred A. Rosenbloom, Jr., O.D., Chicago. An eight-hour course. $32.00. (Course limited to 20.) Periods W-10, W-11, W-2, W-3, T-10, T-11, T-2, T-3.

All aspects of the problem are considered, including causes, psychological factors, patient selection, examination techniques, considerations in selecting the appropriate visual aid, and adaptive training procedures. Both the problems of education and of rehabilitation of the partially blind will be considered. The course will include a clinical demonstration of examination techniques. * * * * *

COURSE 42. Illustration of Ocular Pathology. Jack H. Prince, F.B.O.A., Columbus. A two-hour course. $4.00. Periods F-11, F-12.

Color illustrations of pathological conditions, differential diagnosis and discussion of early symptoms. * * * * *

COURSE 43. Design of Aniseikonic Corrections, Arline W. Rayner, B.Sc., Southbridge, Massachusetts. American Optical Company. (By invitation.) A two-hour course. $4.00. Period F-E.

Following a brief review of factors involved in ophthalmic lens magnifications, several helpful rules-of-thumb will be given for altering spectacle lenses to provide approximate corrections for aniseikonia. A more detailed but relatively simple procedure also will be presented, whereby practitioners may design certain aniseikonic corrections using standard lens blanks and thicknesses available in local laboratories.

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COURSE 44. The Optometrist and His Role in the Reading Problem. Alfred A. Rosenbloom, Jr., O.D., Chicago. A two-hour course. $4.00. Periods F-4, F-5.

Presentation of reading from the readiness period to maturity; diagnosis of a retarded reader, areas of reading impairment, and the contribution of the optometrist to the solution of reading problems will be considered.

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COURSE 45. Headaches of Ocular Origin. Raymond R. Roy, O.D., Portland, Oregon. A two-hour course. $4.00. Periods W-4, W-5.

The following subjects will be included in this course: physiology of headaches, how to take the case history of a patient with headaches, symptoms as an aid in diagnosis, thorough discussion of ocular migraine.

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COURSE 46. Latent Binocular Stress and Prolonged Monocular Occlusion. Raymond R. Roy, O.D., Portland, Oregon. A two-hour course. $4.00. Periods T-2, T-3.

It is commonly known that residual tonicity from fusional movements oftentimes masks a significant phoria. For this reason the main emphasis in this course will be: over twenty methods for testing hyperphoria, an analysis of the problem, what is a phoria, how to prescribe prism, and a standardized technique for prolonged monocular occlusion.

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COURSE 47. Practical Aspects of Industrial Optometry. Herman Sager, O.D., M.S., Lake Success, New York. A two-hour course. $4.00. Periods T-4, T-5.

The course includes: types of industrial vision programs, educational techniques, interprofessional relationship with various forces behind the program, description and application of various types of visual screening instruments, economic aspects involved, methods of association and types of services to be rendered, description and demonstration of various industrial ophthalmic materials and their application.

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COURSE 48. Retinal Images. Charles Sheard, Ph.D., Rochester, Minnesota. A two-hour course. $4.00. Periods F-2, F-3.

Simple calculations and conclusions concerning sizes of retinal images in axial and refractive ametropias; effects of position of correcting lenses; image sizes in astigmatic, anisometropic and aniseikonic conditions. Magnification produced by lenses due to shape, thickness, index of refraction and vertex power and of lens systems used as visual aids. Applications to problems of clinical physiological optics.

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COURSE 49. Management of the Cataract Patient, Frederick W. Sinn, O.D., and Harold Simmerman, O.D., Philadelphia. A four-hour course. $8.00. Periods T-4, T-5, F-4, F-5.

It is commonly known that many difficulties are encountered in meeting visual needs of patients with aphakia. These will be reviewed; the roles of vertex distance, tilt of lenses, center thickness, base curves, etc., also will be discussed.

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COURSE 50. Characteristics of Multifocal

Lenses. Frederick W. Sinn, O.D., Philadelphia. A two-hour course. $4.00. Periods F-8, F-9.

This course will include a discription of essential characteristics of all modern types of multifocal lenses with particular attention to new designs of bifocal lenses and various designs of trifocal lenses. Consideration also will be given to criteria in fitting multifocal lenses as well as indications for use of a particular design of lens.

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COURSE 51. Space Eikonometer Technique of Measuring Aniseikonia. Donald A. Springer, O.D., Anniston, Alabama. A one-hour course. $2.00. Period W-1.

This course will be devoted to the step-by-step procedure of measuring aniseikonia with the Space Eikonometer. The presentation will include not only the technique for usual patients, but also for more complicated cases which have difficulty in making reliable responses. The subject material will be essentially practical and based upon actual clinical experiences. Specific questions germane to the technique of *measuring* aniseikonia will be discussed during the course.

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COURSE 52. House Calls: Examination and Fitting of the Invalid. Charles R. Stewart, O.D., Ph.D., Houston. A one-hour course. $2.00. Period F-1.

This course consists of refracting, prescribing, and fitting invalid patients who are confined to bed. Special equipment and procedures which have been found useful in making house calls are demonstrated.

COURSE 53. Vision Problems in the Navy. Ralph L. Vasa, O.D., Commander, Medical Service Corps, Bethesda, Maryland. A two-hour course. $4.00. Periods W-4, W-5.

A presentation of visual problems in the Navy relative to color vision, stereopsis and other military job requirements. The problems will be discussed in terms of their origin and the research approach to solutions. Recent research will be reported.

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COURSE 54. Use of Polarization in Ophthalmic Practice. Leslie G. Wright, Jr., O.D., Wakefield, Massachusetts. A two-hour course. $4.00. Periods W-4, W-5.

This course will include basic principles of polarization with emphasis on those which are applicable to optometry. Consideration will be given to the colmascope, polarizing ophthalmoscope, malingering tester, etc. The major part of the work will include a detailed description of three dimensional vectograph picture system and its use in orthoptic equipment.

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COURSE 55. Geriatric Optometry. Ralph E. Wick, O.D., Rapid City, South Dakota. A two-hour course. $4.00. Periods T-8, T-9.

The average age of the population of the United States gradually is increasing and with this increase there has been a corresponding growth in the problems of the aged. As a consequence, a whole new field of health care has evolved. In this course chief attention will be given to principles of geriatrics and the expected visual changes with age; new techniques for visual care of the aging also will be presented.

CONDENSED SCHEDULE OF COURSES

Course	Instructor	Subject	Hours	Periods
1	Allen	Subjective Testing Procedures, $4.	2	F-10, F-11
2	Allen	Prism Prescription for Lateral Imbalance, $2.	1	F-2
3	Alton	Basic Principles in Fitting Prosthetic Eyes, $4.	2	T-12, T-1
4	Anapolle	Visual Training and Speed Reading, $8.	4	W-12, W-1 T-12, T-1
5	Bebber	Accounting and Office Procedures, $4.	2	F-E
6	Bing	Vision Care of Children, $12.	6	T-4, T-5, F-8, F-9, F-12, F-1
7	Bruce	Pathology of the Cornea, $4.	2	F-8, F-9
8	Cline	Absorptive Lenses, $4.	2	W-8, W-9
9	Connolly & Hathaway	Review and Evaluation of Reminder Systems, $2.	1	F-1
10	Connolly	Signs and Symptoms of Aniseikonia, $2.	1	F-10
11	Copeland	Streak Retinoscopy, $8.	4	W-E, T-E
12	Eschbach	Occupational Vision in the Army, $2.	1	W-1
13	Dick	Practice Management, $4.	2	T-8, T-9
14	Feinberg & Sherman	Optometric Participation in Occupational and Motorists Vision Programs, $4.	2	F-2, F-3

Course	Instructor	Subject	Hours	Periods
15	Feinbloom, Filderman & Williams	Sub-Normal Vision and Clinic, $16.	4	W-E, T-E
16	Feinbloom	The Physiological Optics of the Partially Blind Eye, $4.	2	F-10, F-11
17	Finkelstein	Corneal Physiology and Contact Lenses, $2.	1	F-11
18	Finkelstein	Clinical Aspects of Contact Lenses, $2.	1	F-5
19	Fry	Evaluation of Quality in Ophthalmic Lenses, $2.	1	F-10
20	Fry	Vision Discomfort—Role of Glare Sources and the Pupil, $2.	1	F-4
21	Giglio	Amblyopia, $4.	2	F-12, F-1
22	Graham, Feinbloom & Mazow	Advanced Course on Corneal Lenses, $32.	8	W-10, W-11, W-2, W-3 T-10, T-11, T-2, T-3
23	Guth	Lighting Design for Effective Working, $4.	2	T-10, T-11
24	Haffner	Optometric Participation in Community Health and Welfare Programs, $4.	2	T-12, T-1
25	Heath	Color Deficiency in School Children, $2.	1	F-3
26	Heath	Haploscopic Testing of Binocular Vision, $4.	2	T-12, T-1
27	Hebbard	Screening of Visual Fields with Multi-pattern Test Targets, $4.	2	F-2, F-3
28	Hirsch	Ocular Pathology Review Organized by the Section on Pathology, American Academy of Optometry, $8.	4	W-E, T-E
29	Hirsch	Multifocal Lenses for Anisometropic Patients, $2.	1	W-4
30	Hofstetter	Practice Management for Better Inter-Professional Relations, $4.	2	F-8, F-9
31	Kratz	Differential Diagnosis of Myopia, $4.	2	W-2, W-3
32	MacLeod	Recent Developments in Ophthalmic Dispensing, $8.	4	T-4, T-5, F-4, F-5
33	Mark	Clinical Aspects of Ocular Motility, $4.	2	W-8, W-9
34	Mazow	Introduction to Slit Lamp Microscopy, $16.	4	W-E, T-E
35	Morgan	Turville Infinity Balance Test, $4.	2	W-10, W-11
36	Morgan	Unfavorable Prognostic Conditions in Strabismus, $4.	2	T-8, T-9
37	Namias	Adjusting Modern Ophthalmic Frames, $4.	2	W-12, W-1
38	Neill	Modern Contact Lens Fitting, $32.	8	W-10, W-11 W-2, W-3, T-10, T-11, T-2, T-3
39	Peters	Prepaid Optometric Services, $4.	2	F-E
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50	Sinn	Characteristics of Multifocal Lenses. $4.	2	F-8, F-9
51	Springer	Space Eikonometer Technique of Measuring Aniseikonia. $2.	1	W-1
52	Stewart	House Calls: Examination and Fitting of the Invalid. $2.	1	F-1
53	Vasa	Vision Problems in the Navy. $4.	2	W-4, W-5
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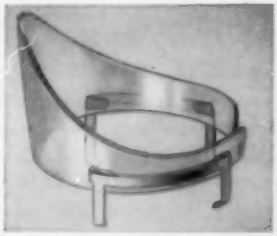

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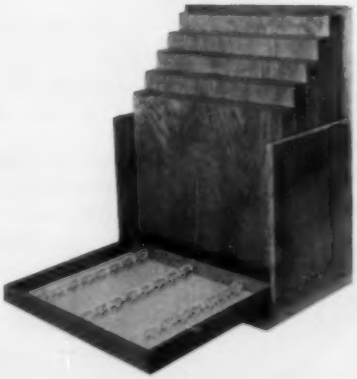

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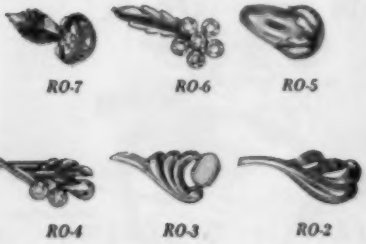

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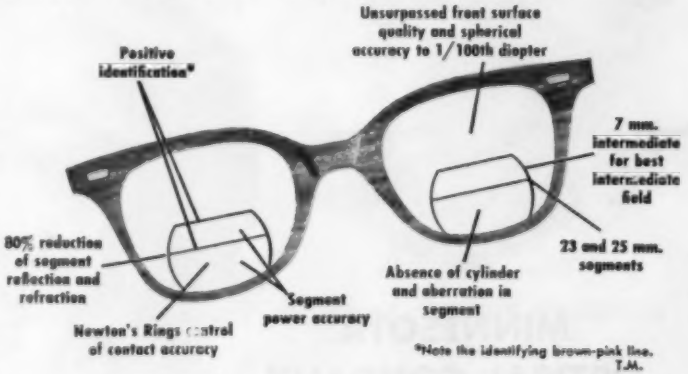
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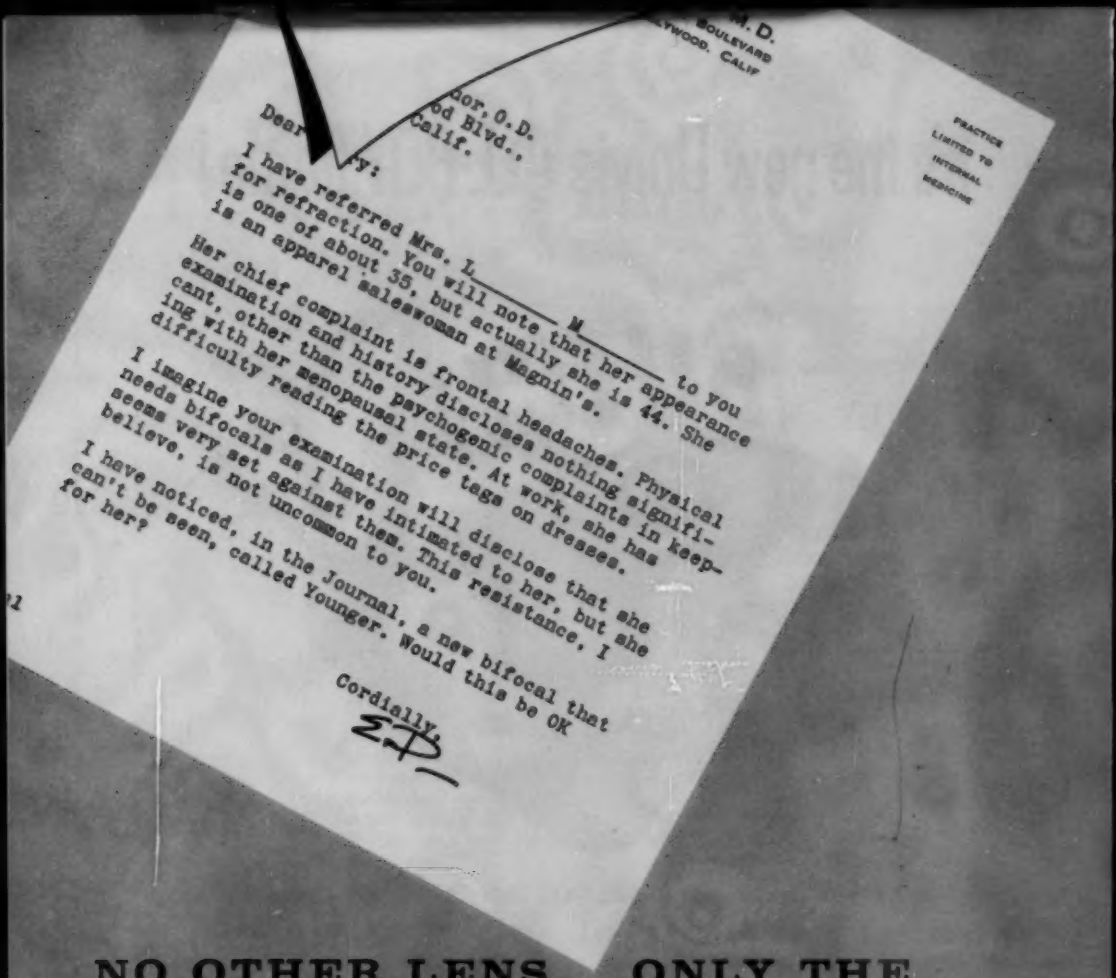
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